US Army Corps
of Engineers
Louisville District

Solicitation for

Renovate RSC Headquarters
Devens, MA

5 August 1998

SFB DACA27-99-B-0027

** SAFETY PAYS **

Modular Design System

Renovate Commissary
for RSC Headquarters
Fort Devens, MA

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OMB APPROVAL NO. 2700-0042

SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	DACA27-99-B-0027	☒ SEALED BID (SFB) ☐ NEGOTIATED	5 Aug 1999	1 of 5

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.

7. ISSUED BY CODE	8. ADDRESS OFFER TO
U.S. Army Engineer District, Louisville Corps of Engineers 600 Dr. Martin Luther King, Jr. Place Louisville, Kentucky 40202-2230	U.S. Army Engineer District, Louisville Corps of Engineers 600 Dr. Martin Luther King, Jr. Place, Room 821 Louisville, Kentucky 40202-2230

9. FOR INFORMATION CALL:	A. NAME See Instructions	B. TELEPHONE NO. *(Include area code)* ***(NO COLLECT CALLS)*** See Instruction

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder."

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying no., date):*

RENOVATE RSC HEADQUARTERS, DEVENS, MA

The Project involves renovation of the existing decommissioned commissary to provide adequate space to support operations for the 94th RSC Headquarters. The renovated facility includes administrative areas, classrooms, storage, and special purpose spaces.

THIS PROCUREMENT IS 8(a) COMPETITIVE. ONLY 8(a) FIRMS LOCATED WITHIN THE GEOGRAPHICAL AREAS SERVICED BY SBA REGION I ARE ALLOWED TO SUBMIT A BID FOR THIS PROCUREMENT. THIS INCLUDES THE STATES OF CT, MA, ME,NH, NJ, NY, RI , AND VT. ALL OTHER FIRMS ARE DEEMED INELEGIBLE TO SUBMIT OFFERS.

The estimated cost range of this project is from $1,000,000 to $5,000,000.00

BID MODIFICATIONS RECEIVED BY FACSIMILE OR TELETYPE WILL NOT BE CONSIDERED.

DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990) FAR 52.211-14: This is a rated order certified for national defense use, and the Contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700), PRIORITY RATING: DO-C2

11. The Contractor shall begin performance within _10_ calendar days and complete it within _**_ calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. *(See **Section 00800, Para 1.)*

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS?	12B. CALENDAR DAYS
☒ YES ☐ NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and _2__ copies to perform the work required are due at the place specified in Item 8 by **_3:00 p.m.** *(hour)* local time **_8 Sep 1999**_____ *(date)*. If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than __60___ calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*	15. TELEPHONE NO. *(Include area code)*
DUNS #	16. REMITTANCE ADDRESS *(Include only if different than Item 14)*
CODE FACILITY CODE	TIN #

17. The offeror agrees to perform the work at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government within __60___ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)*

AMOUNTS	Bidders shall show his prices on the Bid Schedule of this section.

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*	20B. SIGNATURE	20C. OFFER DATE

AWARD *(To be completed by Government)*

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA	
24. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified) Will be identified in Delegation letters.*	ITEM: Sec 105 Para. 30	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 U.S.C. 2304(c)( ) ☐ 41 U.S.C. 253(c)( )
26. ADMINISTERED BY CODE U.S. Army Engineer District, New York District 26 Federal Plaza New York, NY 10278-0090		27. PAYMENT WILL BE MADE BY USACE Finance Ctr. (UFC) 5720 Integrity Drive EFT:T Millington, TN 38054-5005

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return ____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration slated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.	☐ 29. AWARD *(Contractor is not required to sign this document* Your offer on this solicitation is hereby accepted as to the item listed. This award consummates the contract, which consists of (a the Government solicitation and your offer, and (b) this contrac award. No further contractual document is necessary.
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*	31A. NAME OF CONTRACTING OFFICER *(Type or print)*

30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

ALL BIDDERS READ THE FOLLOWING INSTRUCTIONS

1. Each bidder shall, upon request of the Contracting Officer, furnish a list of the plant available to the bidder and proposed for use of the work.

2. Bidders are cautioned that drawings may not be reproduced to exact scale. All drawings, whether full size or reduced, should be checked for potential discrepancies, dimensions and scales should be verified and all drawings compared.

3. Bidders are required to acknowledge receipt of all amendments to this solicitation on Standard Form 1442 in the space provided, by completing Blocks 8 and 15 of the Amendment Form (SF 30), by separate letter, or by telegram prior to opening of bids. Failure to acknowledge all amendments may cause rejection of the bid/proposal.

4. Telegraph modifications may be received at the bidding office by telephone from the receiving telegraph company. The telegraph company shall call (502) 582-5591 to deliver the message. The telegraph company shall confirm the message by sending a copy of the written telegram to the bidding office within 7 calendar days of delivery of the telephone message.

CAUTION TO BIDDERS

BEFORE SIGNING AND MAILING THIS BID, PLEASE TAKE NOTE OF THE FOLLOWING, AS FAILURE TO PERFORM ANY ONE OF THESE ACTIONS MAY CAUSE YOUR BID TO BE REJECTED.

1. **AMENDMENTS**. Have you acknowledge receipt of ALL amendments? If in doubt as to the number of amendments issued, please contact our office.

2. **AMENDED BID PAGES**. If any of the amendments furnished amended bid pages, the amended bid pages must be used for preparation of your bid.

3. **LATE BIDS**. Please refer to the Instructions section contained in this package.

4. **BID GUARANTEE**. If bid guarantee is required for this project, sufficient bid guarantee in proper form must be furnished with your bid for construction projects exceeding $100,000.

5. **MISTAKE IN BID**. Have you reviewed your bid prices for possible errors in calculations or work left out?

6. **FAX MODIFICATIONS OF BIDS**. We do not permit modifications of bids by fax.

BID SCHEDULE

CONTINUATION SHEET	REFERENCE NO. DOCUMENT BEING CONTUNUED DACA27-99-B-0027	PAGE 5 of 5

NAME OF OFFEROR OR CONTRACTOR

ITEM NO.	SUPPLIES/SERVICES	QTY	UNIT	UNIT PRICE	AMOUNT
	Renovate RSC Headquarters – Devens, MA				
1	Primary Facilities	1	LS		$_____
2	Wire Mesh Caging (OMAR)	1	LS		$_____
	TOTAL BASE BID				$_____
	BID OPTIONS				
O1	N. Elevation Windows	1	LS		$_____
O2	E. Elevation Windows	1	LS		$_____
	TOTAL BASE BID + OPTIONS				$_____
	Prices for the options shall be good for 180 days after award of the contract. The project duration shown in Section 00800, para. 1 will not be affected by the exercising of the options. Special Bid Conditions. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.				

16 February 1999

SECTION 00105

INSTRUCTIONS FOR SEALED BID CONTRACTS

2 Jan 96
1. SOLICITATION DEFINITIONS - SEALED BIDDING - (July 1987) FAR 52.214-1.

"Government" means United States Government. "Offer" means "bid" in sealed bidding. "Solicitation" means an invitation for bids in sealed bidding.

2. AMENDMENTS TO INVITATIONS FOR BIDS (DEC 1989) FAR 52.214-3.

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid, 3) by letter or telegram, or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids.

3. FALSE STATEMENTS IN BIDS (APR 1984) FAR 52.214-4.

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

20 March 1997
4. SUBMISSION OF BIDS (MAR 1997) FAR 52.214-5 (Para. a-e only).

(a) Bids and bid modifications shall be submitted in sealed envelopes or packages, (unless submitted by electronic means).

(1) Addressed to: U.S. Army Engineer District, Louisville
600 Dr. Martin Luther King, Jr. Place
Room 821
Louisville, Kentucky 40202-2230

(2) Showing the time specified for receipt, the solicitation number, and the name and address of the bidder.

(b) Bidders using commercial carrier services shall ensure that the bid is addressed and marked on the outermost envelope or wrapper as prescribed in subparagraphs (a)(1) and (2) of this provision when delivered to the office specified in the solicitation.

(c) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.

(d) Facsimile bids, modifications, or withdrawals will not be considered unless authorized by the solicitation.

(e) Bids submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

(f) Hand-carried bids shall be deposited in the depository located in Room 821, Federal Building, 600 Dr. Martin Luther King, Jr. Place, Louisville, Kentucky.

(g) Express mail bids shall be addressed as shown in Paragraph (a) (1) above, ATTN: CEORLCT/Hitner.

5. EXPLANATION TO PROSPECTIVE BIDDERS (APR 1984) FAR 52.214-6.

Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders.

20 March 1997
6. LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS (MAY 1997) FAR 52.214-7.

(a) Any bid received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it--

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for the receipt of bids (e.g., a bid submitted in response to a solicitation requiring receipt of bids by the 20th of the month must have been mailed by the 15th); or

(2) Was sent by mail (or telegram or facsimile, if authorized) or hand-carried (including delivery by a commercial carrier) if it is determined by the Government that the late receipt was due primarily to Government mishandling after receipt at the Government installation;

(3) Was sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee, not later than 5:00 P.M. at the place of mailing two working days prior to the date specified for receipt of bids. The term "working days" excludes weekends and U.S. Federal holidays; or

(4) Was transmitted through an electronic commerce method authorized by the solicitation and was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of bids.

(b) Any modification or withdrawal of a bid is subject to the same conditions as in paragraph (a) of this provision.

(c) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the bid, modification, or withdrawal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(d) The only acceptable evidence to establish the time of receipt at the Government installation is the time/date stamp of that installation on the bid wrapper or other documentary evidence of receipt maintained by the installation.

(e) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (c) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(f) Notwithstanding paragraph (a) of this provision, a late modification of an otherwise successful bid that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(g) Bids may be withdrawn by written notice or telegram (including mailgram) received at any time before the exact time set for receipt of bids. If the solicitation authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids subject to the conditions specified in the provision entitled “Facsimile Bids.” A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for receipt of bids, the identify of the person requesting withdrawal is established and the person signs a receipt for the bid.

(h) If an emergency or unanticipated event interrupts normal Government processes so as to cause postponement of the scheduled bid opening, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the opening date, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

7. PREPARATION OF BIDS - CONSTRUCTION (APR 1984) FAR 52.214-18.

(a) Bids must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a bid must initial each erasure or change appearing on any bid form.

(b) The bid form may require bidders to submit prices for one or more items on various bases, including -

(1) Lump sum bidding;
(2) Alternate prices;
(3) Units of construction; or
(4) Any combination of subparagraphs (1) through (3) above.

(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

(d) Alternate bids will not be considered unless this solicitation authorizes their submission.

8. NOT USED.

9. NOT USED.

10. BIDDER'S QUALIFICATIONS.

Before a bid is considered for award, the bidder may be requested by the Government to submit a statement regarding his previous experience in performing comparable work, his business and technical organization,

financial resources, and plant available to be used in performing the work. The successful bidders will be required to submit his Workman's Compensation Experience Modification Rate (EMR) for the previous 3 years.

11. NOT USED.

28 March 1998
12. BID GUARANTEE (SEP 1996) FARS 52.228-1 (Para. (a) - (e) only).

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, such as a bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

(c) The amount of the bid guarantee shall be 20 percent of the bid price or $3,000,000, whichever is less.

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the Bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(f) The Bid Bond penalty may be expressed in terms of a percentage of the bid price or may be expressed in dollars and cents. Bid bonds are not required for projects under $100,000.

(g) Individual Sureties. See Paragraph 15.

20 March 1997
13. PERFORMANCE AND PAYMENT BONDS. After the prescribed forms are presented to the bidder to whom award is made for signature, a written contract on the form prescribed by the specifications shall be executed and two bonds, each with good and sufficient surety or sureties acceptable to the Government shall be furnished: a Performance Bond (Standard Form 25) and a Payment Bond (Standard Form 25A). The penal sums of such bonds will be as follows:

(a) Performance Bond. The penal sum of the performance bond shall equal one hundred percent (100%) of the contract price.

(b) Payment Bond.

(1) When the contract price is $1,000,000 or less, the penal sum will be fifty percent (50%) of the contract price.

(2) When the contract price is in excess of $1,000,000 but not more than $5,000,000, the penal sum shall be forty percent (40%) of the contract price.

(3) When the contract price is more than $5,000,000 the penal sum shall be $2,500,000.

(c) For rules covering the use of individual sureties see Paragraph 15. Any bonds furnished will be furnished by the Contractor to the Government prior to commencement of contract performance.

14. NOT USED.

15. RULES FOR USE OF INDIVIDUAL SURETIES.

(a) One individual surety is adequate support for a bond, provided the unencumbered value of the assets pledged by that individual surety equal or exceed the amount of the bond. An offeror may submit up to three individual sureties for each bond, in which case the pledged assets when combined must equal or exceed the penal amount of the bond. Each individual surety must accept both joint and several liability to the extent of the penal amount of the bond.

(b) An individual surety may be accepted only if a security interest in acceptable assets is provided to the Government by the individual surety. The security interest shall be furnished with the bond, and may be provided by one or a combination of the following methods:

(1) An escrow account with a federally insured financial institution in the name of the contracting agency.

(2) A lien on real property, subject to restrictions contained herein.

(c) Acceptable assets include:

(1) Cash or certificates of deposit, or other cash equivalents with a federally insured financial institution;

(2) United States Government securities at market value;

(3) Stocks and bonds actively traded on a national U.S. security exchange with certificates issued in the name of the individual surety (these assets will be accepted at 90 percent of their 52 week low, as reflected at the time of submission of the bond);

(4) Real property owned in fee simple by the surety without any form of concurrent ownership (these assets will be accepted at 100 percent of the most current tax assessment value exclusive of encumbrances or 75 percent of the properties' unencumbered market value provided a current appraisal is furnished);

(5) Irrevocable letters of credit (ILC) issued by a federally insured financial institution in the name of the contracting agency and which identify the agency and solicitation or contract number for which the ILC is provided.

(d) Unacceptable assets include but are not limited to:

(1) Notes or accounts receivable;

(2) Foreign securities;

(3) Real property as follows:

a. Real property located outside the United States, its territories, or possessions.

b. Real property which is a principal residence of the surety.

c. Real property owned concurrently regardless of the form

of co-tenancy except where all co-tenants agree to act jointly.

d. Life estates, leasehold estates, or future interests in real property.

(4) Personal property such as jewelry, furs, antiques;

(5) Stocks and bonds of the individual surety in a controlled, affiliated, or closely held concern of the Offeror/Contractor;

(6) Corporate assets (e.g., plant and equipment);

(7) Speculative assets (e.g., mineral rights);

(8) Letters of credit, except as provided in subparagraph c(5) above.

(e) With respect to the acceptance of real property, the individual surety shall provide:

(1) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice;

(2) Evidence of the amount due under any encumbrance shown in the evidence of title;

(3) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice.

(4) Failure to provide evidence that the lien has been properly recorded will render the offeror nonresponsible.

(f) An individual may be excluded from acting as individual surety on bonds for any of the following causes:

(1) Failure to fulfill the obligations under any bond.

(2) Failure to disclose all bond obligations.

(3) Misrepresentation of the value of available assets or outstanding liabilities.

(4) Any false or misleading statement, signature or representation on a bond or affidavit of individual suretyship.

(5) Any other cause affecting responsibility as a surety of such serious and compelling nature as may be determined to warrant exclusion.

An individual surety excluded pursuant to this subsection shall be included on the list entitled "Parties Excluded from Procurement Programs."

(g) Any bidder or offeror should carefully review these requirements which are set forth in Section 28 of the Federal Acquisition Regulations (FAR).

20 March 1997
16. SITE VISIT FAR (APR 1984) 52.237-1.

Offerors or quoters are urged and expected to inspect the site where services are to be performed and to satisfy themselves regarding all general and local conditions that may affect the cost of contract performance, to the extent that the information is reasonably obtainable. In no event shall failure to inspect the site constitute grounds for a claim after contract award. Site visits may be arranged during normal duty hours by contacting:

Ray Prisk
978-796-3582

22 Jan 99
17. REQUESTS FOR INFORMATION. Telephone inquiries relating to this procurement should be directed to the Louisville District, Corps of Engineers, as listed below: ORAL EXPLANATIONS OR INSTRUCTIONS GIVEN BEFORE THE AWARD OF A CONTRACT WILL NOT BE BINDING. SEE PARAGRAPH 5: "EXPLANATION TO PROSPECTIVE BIDDERS" FOR PROPER PROCEDURES.

Procurement of Plans
& Specifications—Debbie Lardner.....502/625-7318
Prospective Bidders may find the planholders list on the Internet at
http://www.lrl.usace.army.mil/cnt/ct_pages.htm

Technical Questions on Plans
& Specifications—Betty Beck.....502/582-5380
FAX.....502/582-6763

18. LOCATION OF BID OPENING. Directions and map to the bid opening address are attached at the end of this section.

24 Sep 1998
19. AVAILABILITY OF SPECIFICATIONS LISTED THE IN GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS, FPMR Part 101-29 (AUG 1998) FAR 52.211-1

(a) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29, and copies of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained for a fee by submitting request to—

GSA Federal Supply Service
Specifications Section, Suite 8100
470 East L'Enfant Plaza, SW
Washington, DC 20407, Telephone (202) 619-8925,
Facsimile (202) 619-8978

(b) If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitations, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

4 August 1998
20. AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) AND DESCRIPTIONS LISTED IN THE ACQUISITION MANAGEMENT SYSTEMS AND DATA REQUIREMENTS CONTROL LIST, DOD 5010.12-L (AUG 1998) FAR 52.211-2

(a) Copies of specifications, standards, and data item descriptions cited in this solicitation may be obtained for a fee by submitting a request to the—

Department of Defense Single Stock Point (DoDSSP)
Building 4, Section D
700 Robbins Avenue

Philadelphia, PA 19111-5094
Telephone (215) 697-2667/2179
Facsimile (215) 697-1462

(b) Order forms, pricing information, and customer support information may be obtained—

(1) By telephone (215) 697-2667/2179; or

(2) Through the DoDSSP Internet site at http://www.dodssp.daps.mil.

20 March 1997
21. AVAILABILITY OF SPECIFICATIONS AND STANDARDS NOT LISTED IN DODISS, DATA ITEM DESCRIPTIONS NOT LISTED IN DOD 5010.12-L, AND PLANS, DRAWINGS, AND OTHER PERTINENT DOCUMENTS (DEC 1991) DFARS 252.211-7001

Offerors may obtain the specifications, standards, plans, drawings, data item descriptions, and other pertinent documents cited in this solicitation by submitting a request to:

Technical Point of Contact stated in Paragraph 17.

Include the number of the solicitation and the title and number of the specification, standard, plan, drawings, or other pertinent document.

22 June 1998
(2) 22. NOTIFICATION OF COMPETITION LIMITED TO ELIGIBLE 8(a) CONCERNS. (JAN 1997) ALTERNATE I (NOV 1989) FAR 52.219-18I

(a) Offers are solicited only from small business concerns expressly certified by the Small Business Administration (SBA) for participation in the SBA's 8(a) Program and which meet the following criteria at the time of submission of offer--

(1) SIC code 1542 is specifically included in the Offeror's approved business plan;

(2) The Offeror is in conformance with the 8(a) support limitation set forth in its approved business plan; and

(3) The Offeror is in conformance with the Business Activity Targets set forth in its approved business plan or any remedial action directed by the SBA.

(4) The Offerors' approved business plan is on the file and serviced by SBA Region I.

(b) By submission of its offer, the Offeror represents that it meets all of the criteria set forth in the paragraph (a) of this clause.

(c) Any award resulting from this solicitation will be made to the Small Business Administration, which will subcontract performance to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.

(d)(1) Agreement. A small concern submitting an offer in its own name agrees to furnish, in performing the contract, only end items manufactured or produced by small business concerns in the United states. the term "United States" includes its territories and possessions, the Commonwealth of Puerto Rico, the Trust Territory of the Pacific Islands, and the District of Columbia. If this procurement is

processed under simplified acquisition procedures and the total amount of this contract does not exceed $25,000, a small business concern may furnish the product of any domestic firm. This subparagraph does not apply in connection with construction or service contracts.

(2) The Contractor will notify the Contracting Officer in writing immediately upon entering an agreement (either oral or written) to transfer all or part of its stock or other ownership interest to any other party.

16 Feb 1999
23. INDUSTRY SMALL BUSINESS SIZE STANDARDS (JAN 1999) FAR 19.102.

23.1 General.

(a) The SBA establishes small business size standards on an industry-by-industry basis. (See 13 CFR 121.)

(b) Small business size standards are applied by--

(1) Classifying the product or service being acquired in the industry whose definition, as found in the Standard Industrial Classification (SIC) Manual, best describes the principal nature of the product or service being acquired.

(2) Identifying the size standard SBA established for that industry; and

(3) Specifying the size standard in the solicitation, so that offerors can appropriately represent themselves as small or large.

(c) For size standard purposes, a product or service shall be classified in only one industry, whose definition best describes the principal nature of the product or service being acquired even though for other purposes it could be classified in more than one.

(d) When acquiring a product or service that could be classified in two or more industries with different size standards, contracting officers shall apply the size standard for the industry accounting for the greatest percentage of the contract price.

(e) If a solicitation calls for more than one item and allows offers to be submitted on any or all of the items, an offeror must meet the size standard for each item it offers to furnish. If a solicitation calling for more than one item requires offers on all or none of the items, an offeror may qualify as a small business meeting the size standard for the item accounting for the greatest percentage of the total contract price.

(f) Any concern which submits a bid or offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is deemed to be a small business when it has no more than 500 employees, and---

(1) In the case of Government acquisitions set-aside for small businesses, such nonmanufacturer must furnish in the performance of the contract the product of a small business manufacturer or producer, which end product must be manufactured or produced in the United States. The term "nonmanufacturer" includes a concern which can manufacture or produce the product referred to in the specific acquisition but does not do so in connection with that acquisition. For size determination purposes there can be only one manufacturer of the end item being procured. The manufacturer of the end item being acquired is the concern which, with its own forces, transforms inorganic or organic substances including raw materials and/or

miscellaneous parts or components into such end item. Whether a bidder on a particular acquisition is the manufacturer or a nonmanufacturer for the purpose of a size determination need not be consistent with whether such concern is or is not a manufacturer for the purpose of the Walsh-Healey Act.

(2) A concern which purchases items and packages them into a kit is considered to be a nonmanufacturer small business and can qualify as such for a given acquisition if it meets the size qualifications of a small nonmanufacturer for acquisition, and if more than 50 percent of the total value of the kit and its contents is accounted for by items manufactured by small business.

(3) For the purpose of receiving a Certificate of Competency on an unrestricted acquisition, a small business nonmanufacturer may furnish any domestically produced or manufactured product.

23.2 The industry size standards are set forth in the following table. The table column labeled "SIC" follows the standard industrial classification code as published by the Government in the Standard Industrial Classification Manual. The Manual is intended to cover the entire field of economic activities. It classifies and defines activities by industry categories and is the source used by SBA as a guide in defining industries for size standards. The number of employees or annual receipts indicates the maximum allowed for a concern, including its affiliates, to be considered small.

23.3 Size standards for construction and special trades.

A concern is small if its average annual receipts for its preceding 3 fiscal years did not exceed $17 million. However, if 75 percent or more of the work (in terms of dollar value) called for by the contract is classified in one of the industries, subindustries, or classes of products listed in this paragraph, the concern is small if its average annual receipts for its preceding 3 fiscal years did not exceed the size standard for that industry, subindustry, or class of products. (See Division C, "Contract Construction," of the SIC Manual).

Classification Code	Industry, Subindustry, or Class of Products	Size Standard*
	MAJOR GROUP 15--BUILDING CONSTRUCTION--GENERAL CONTRACTORS AND OPERATIVE BUILDERS	
1521	General Contractors--Single-Family House	$17.0
1522	General Contractors--Residential Buildings, Other Than Single-Family	17.0
1531	Operative Builders	17.0
1541	General Contractors--Industrial Buildings and Warehouses	17.0
1542	General Contractors--Nonresidential Buildings Other Than Industrial Buildings and Warehouse	17.0
	MAJOR GROUP 16--CONSTRUCTION OTHER THAN BUILDING CONSTRUCTION--GENERAL CONTRACTORS	
1611	Highway and Street Construction, Except Elevated Highway	17.0
1622	Bridge, Tunnel, and Elevated Highway Construction	17.0
1623	Water, Sewer, Pipe Line, Communication and Power Line Construction	17.0
1629	Heavy Construction, Except Dredging N.E.C.	17.0
1629	Dredging and Surface Cleanup Activities	13.5
	MAJOR GROUP 17--CONSTRUCTION--SPECIAL TRADE	

1711	Plumbing, heating (except electric), and air conditioning	$7
1721	Painting, paperhanging, and decorating	7
1731	Electrical Work	7
1741	Masonry, stone setting, and other stonework	7
1742	Plastering, drywall, acoustical and insulation work	7
1743	Terrazzo, tile, marble, and mosaic work	7
1751	Carpentry Work	7
1752	Floor laying and other floorwork, not elsewhere classified	7
1761	Roofing, siding and sheet metal work	7
1771	Concrete work	7
1781	Water well drilling	7
1791	Structural steel erection	7
1793	Glass and glazing work	7
1794	Excavating and foundation work	7
1795	Wrecking and demolition work	7
1796	Installation or erection of building equipment, not elsewhere classified	7
1799	Special trade contractors, not elsewhere classified	7

* (Average Annual Receipts) (Millions)

24. CONTRACT PRICES - BIDDING SCHEDULES (DEC 1991) DFARS 52.236-7008.

(a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for--

(1) Furnishing all plant, labor, equipment, appliances, and materials; and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

(b) The Contractor shall include in the prices for the items in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

2 Jan 96
25. ARITHMETIC DISCREPANCIES EFARS 52.214-5000.

(a) For the purpose of initial evaluations of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by the bidder:

(1) Obviously misplaced decimal points will be corrected;

(2) In case of discrepancy between unit prices and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected; and

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

1 February 1995
26. WAGE RATES. The Wage Decisions of the Secretary of Labor are applicable to the work to be performed under this contract and are contained in SECTION 00800, SPECIAL CONTRACT REQUIREMENTS. Modifications are periodically made to the wage decisions. The complete modifications will be issued by amendment to the solicitation.

24 Sep 1998
27. MODIFICATIONS PRIOR TO DATE SET FOR OPENING BIDS. The right is reserved, as the interest of the Government may require, to revise or amend the specifications and/or drawings prior to the date set for opening of bids. Such revisions and amendments, if any, will be announced by an amendment or amendments to this Invitation for Bids. Copies of such amendments as may be issued will be furnished to all prospective bidders. If the revisions and amendments are of a nature which require material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the Contracting Officer will enable bidders to revise their bids. In such cases, the amendment will include an announcement of the new date for opening bids.

24 Sep 1998
(1)28. NOTICE OF BUY AMERICAN ACT REQUIREMENTS – CONSTRUCTION MATERIALS. (MAY 1997) FAR 52.225-12

(a) Offerors are required to comply with the requirements of Federal Acquisition Regulation (FAR) clause 52.225-5, Buy American Act – Construction Materials, of this solicitation. The terms “construction material” and “domestic construction material,” as used in this provision, have the meanings set forth in FAR clause 52.225-5.

(b) Offerors should request a determination regarding the inapplicability of the Buy American Act in time to allow determination before submission of offers. For evaluation of a request for a determination regarding the inapplicability of the requirements of the Buy American Act prior to the time set for receipt of offers, the information and applicable supporting data required by paragraphs (c) and (d) of Far clause 52.225-5 shall be included in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act prior to submission of its offer, or has not received a response to a request made prior to submission of its offer, the information and supporting data shall be included in the offer.

(c) Evaluation of offers.

(1) For evaluation of offers, (unless agency regulations specify a higher percentage) the Government will add to the offered price 6 percent of the cost of any foreign construction material proposed for exception from the requirements of the Buy American Act based on claimed unreasonable cost of domestic construction materials in accordance with paragraph (b)(3)(i) of FAR clause 52.225-5.

(2) If the evaluation of offers results in a tie between an offer including such foreign construction material excepted on the basis of unreasonable cost, as evaluated, and an offer including solely domestic construction material or other foreign construction material listed in the solicitation at paragraph (b)(2) of FAR clause 52.225-5, or subsequently excepted in accordance with paragraphs (b)(3)(ii) or (iii) of FAR clause 52.225-5, award shall be made to the offeror that submitted the latter offer.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in the solicitation at paragraph (b)(2) of Far clause 52.225-5, offerors also may submit alternate offers base on use of equivalent domestic construction.

(2) If alternate offers are submitted, a separate Standard Form 142 shall be submitted for each alternate offer, and a separate price comparison table, prepared in accordance with paragraph (c) and (d) of FAR clause 52.225-5, shall be submitted for each offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception to apply.

(3) If the Government determines that a particular exception requested under paragraph (c) of FAR clause 52.225-5 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material.

(i) In sealed bid procurements, any offer based on use of that particular foreign construction material shall be rejected as nonresponsive.

(ii) In negotiated procurements, any offer based on use of that particular foreign construction material may not be accepted unless revised during negotiations.

29. LISTING OF EMPLOYMENT OPENINGS. Offerors should note that this solicitation includes a provision requiring the listing of employment openings with the local office of the State employment service system if the award is for $10,000 or more.

22 June 1998
30. SUBMISSION OF INVOICES.

In accordance with Section 00010, Para. 24, submit invoices to:

U.S. Army Corps of Engineers New York District
Attn: Jim Conway
4 Lexington Street
Rm 330
Devens, MA 01432-4432

16 Feb 1999
31. NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999) FAR 52.222-23.

(a) The Offeror's attention is called to the EQUAL OPPORTUNITY and the AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION clauses of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

.....

Goals for minority participation for each trade	Goals for female participation in each trade
1.6%	6.9%

.....

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area. If the Contractor performs construction work (whether or not it is Federal or Federally assisted) in a geographical area located outside the covered area, it shall apply the goals established for the geographical area where such work is actually performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs (OFCCP) Office.

(c) The Contractor's compliance with Executive Order 11246 as amended and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity clause, specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction" and its efforts to meet prescribed goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary, for Federal Contract Compliance, U.S. Department of Labor within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the---

(1) Name, address and telephone number of the subcontractor; (2) Employer’s identification number of the subcontractor; (3) Estimated dollar amount of the subcontract;
(4) Estimated starting and completion dates of the subcontract; and
(5)Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in the contract resulting from this Solicitation, the "covered area" is Worcester County, MA which includes the economic area of Boston, MA.

32. NOT USED.

33. PERFORMANCE OF WORK BY CONTRACTOR. Attention is directed to SPECIAL CONTRACT REQUIREMENT: PERFORMANCE OF WORK BY CONTRACTOR. The apparent low bidder must furnish the Contracting Officer, within 5 working days after bid opening, a description of the work which he intends to perform with his own organization, e.g., earthwork, paving, brickwork, or roofing), the percentage of the total work this represents, and the estimated cost thereof.

15 September 1995
34. MODIFICATION OF BIDS BY FACSIMILE. Bidders WILL NOT be allowed to modify their bids at any time by facsimile or teletype.

35. PAYMENT FOR BOND PREMIUMS. CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS provides that upon presentation of evidence of full payment, the Government will immediately reimburse the Contractor the cost of premiums for performance and payment bonds. This reimbursement amount is not in addition to the amount bid for the work covered by this Invitation for Bids, and bidders are cautioned to include the cost of such premiums in the bid items shown on the Bidding Schedule (or in the lump sum amount of the bid if no bid items are listed). If bond premiums are reimbursed under this clause, such reimbursed amount will be recovered by the Government from the progress payments made to the Contractor or, if no

progress payments are made, from the amount otherwise due the Contractor upon final payment.

36. NOT USED.

37. NOT USED.

20 March 1997
38. SERVICE OF PROTEST (AUG 1996) FAR 52.233-2.

(a) Protests, as defined in Section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO) shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from:

Ms. Denise A. Bauer, Contracting Officer
U.S. Army Engineer District, Louisville
Corps of Engineers - ATTN: CELRLCT
600 Dr. Martin Luther King Jr. Place, Room 821
Louisville, Kentucky 40202-2230

(b) The copy of any protest shall be received in the office designated above on the same day a protest is filed with the GSBCA or within one day of filing a protest with the GAO.

39. COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (DEC 1991) DFARS 252.204-7001

(a) The Offeror is requested to enter its CAGE code on its offer in the block with its name and address. The CAGE code entered must be for that name and address. Enter CAGE before the number.

(b) If the Offeror does not have a CAGE code, it may ask the Contracting Officer to request one from the Defense Logistics Services Center (DLSC). The Contracting Officer will--

(1) Ask the Contractor to complete section B of a DD Form 2051, Request for Assignment of a Commercial and Government Entity (CAGE) Code;

(2) Complete section A and forward the form to DLSC; and

(3) Notify the Contractor of its assigned CAGE code.

(c) Do not delay submission of the offer pending receipt of a CAGE code.

20 March 1997
40. DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (APR 1998) FAR 52.204-6.

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “DUNS” followed by the DUNS number that identifies the offeror’s name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet Information Services.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

(1) Company name.
(2) Company address.

(3) Company telephone number.
(4) Line of business.
(5) Chief executive officer/key manager.
(6) Date the company was started.
(7) Number of people employed by the company.
(8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet Home Page at hhtp://www.dnb.com/. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

41. NOT USED.

20 March 1997
42. NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990) FAR 52.211-14.

42.1 Any contract awarded as a result of this solicitation will be a [ ] DX rated order; [X] DO-C2 rated order certified for national defense use under the Defense Priorities and Allocations System (DFARS) 15 CFR 700, and the Contractor will be required to follow all of the requirements of this regulation.

43. PRICE BASIS. Prices must be firm. Bids will not be considered which provide for subsequent increase in price.

24 Sep 1998
44. CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION (AUG 1996) FAR 52.214-19.

(a) The Government will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price-related factors specified elsewhere in the solicitation.

(b) The Government may reject any or all bids, and waive informalities on minor irregularities in bids received.

(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid.

(d) The Government may reject a bid as nonresponsive if the prices bid are materially unbalanced between line items or subline items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Government even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

45. NOT USED.

46. AWARD TO SINGLE BIDDERS. Subject to the provisions contained herein, award shall be made to a single bidder.

47. NOT USED.

20 March 1997
48. EVALUATION OF OPTIONS (JUL 1990) FAR 52.217-5

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

49. NOT USED.

LOCATION OF BID OPENING. Bidders are provided the following information as a service by the government. The government cannot be held liable for street closures, traffic delays or other problems that may be encountered due to reliance upon the government's suggested routes to the Federal Building.

Motorist coming from I-65 North:

Immediately after crossing the kennedy bridge, take exit I-64 West (St. Louis). Once in I-64, take the 9th street exit. Continue straight on 9th street for approximately seven blocks to Broadway (first major street with two-way traffic). Turn left on Broadway; go two blocks and turn left on 7th street (7th street is one-way north bound). Approximately ½ block north on 7th street is a stop light, our building is on the right just past the light. There should be ample parking available either by street-side or garage parking. Upon entering the building proceed to the eighth floor and go to room 821.

Motorist coming from I-65 South:

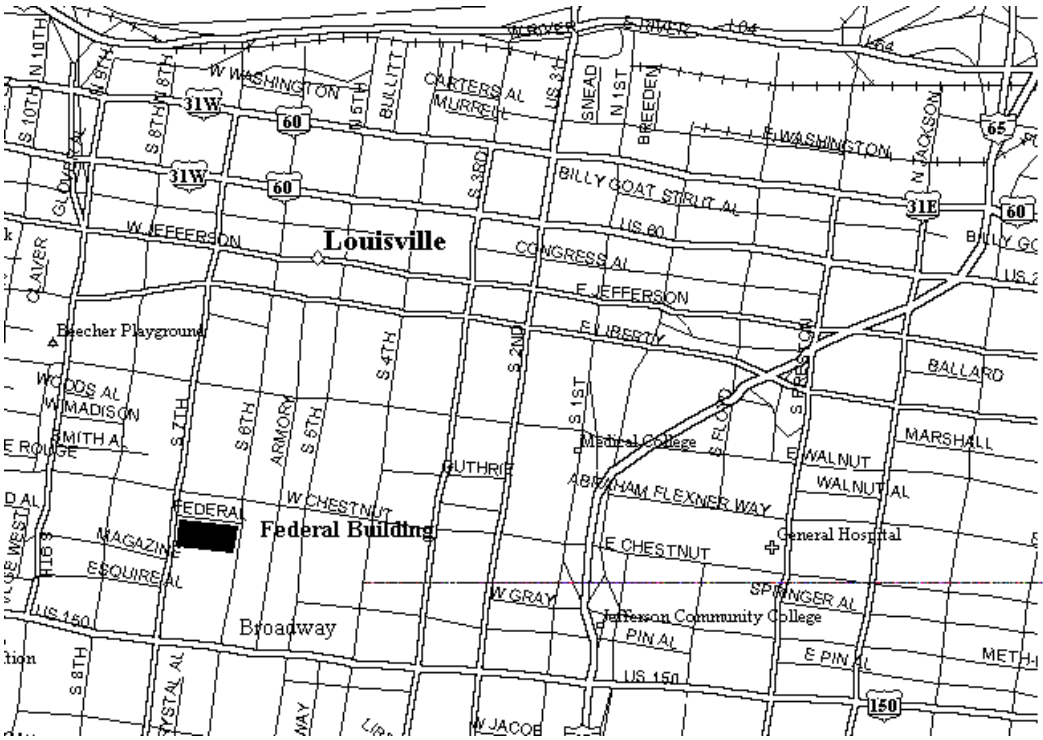
Take Broadway exit and turn left on Broadway (west bound) and continue to 7th street and turn right. Approximately ½ block north on 7th street is a stop light, our building is on the right just past the light. There should be ample parking available either by street-side or garage parking. Upon entering the building proceed to the eighth floor and go to room 821.

Motorist coming from I-64 East and West:

Exit the 9th street exit. At the bottom of the ramp continue south down 9th street for approximately seven blocks until you come to Broadway (first major two way street). Turn left on Broadway and to two blocks and turn left on 7th street (7th street is one-way north bound). Approximately ½ block north on 7th street is a stop light, our building is on the right just past the light. There should be ample parking available either by street-side or garage parking. Upon entering the building proceed to the eighth floor and go to room 821.

Motorist coming from I-71:

Follow routing for intersecting with I-64 and follow the instructions for I-64 motorists.



BIDDER: READ CAREFULLY - CHECK ALL APPLICABLE BOXES

SECTION 00605

REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF BIDDER FOR SEALED BID CONSTRUCTION CONTRACTS

DATE OF OFFER: _____ **DUNS NO. _____**

SOLICITATION NO. _____ **CAGE NO. _____**

NAME AND ADDRESS OF OFFEROR: _____

_____

The offeror makes the following representations and certifications as part of the offer referenced above.

1. CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985) FAR 52.203-2

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision _____ [*insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization*];

(ii) As an authorized agent, does certify that the principals name in subdivision (b)(2)(i) of this provision have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies subparagraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

2. CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991) FAR 52.203-11

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(End of Provision)

3. TAXPAYER IDENTIFICATION (OCT 1998) FAR 52.204-3

(a) **Definitions.**

“Common parent,” as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

“Taxpayer Identification Number (TIN),” as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) **Taxpayer Identification Number (TIN).**

[ ] TIN: _____
[ ] TIN has been applied for.
[ ] TIN is not required because:
- **[ ]** Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;
- **[ ]** Offeror is an agency or instrumentality of a foreign government;
- **[ ]** Offeror is an agency or instrumentality the Federal Government;

(e) **Type of Organization.**

[ ] Sole proprietorship;
[ ] Partnership;
[ ] Corporate entity (not tax-exempt);
[ ] Corporate entity (tax-exempt);
[ ] Government entity (Federal, State, or local);
[ ] Foreign government;
[ ] International organization per 26 CFR 1.6049-4;
[ ] Other _____

(f) **Common Parent.**

[ ] Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

[ ] Name and TIN of common parent:

Name _____ TIN_____

(End of provision)

4. WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999) FAR 52.204-5

(a) **Definition.** Women-owned business concern, as used in this provision, means a concern which is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) **Representation.** [*Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation*.] The offeror represents that it **[ ]** is, **[ ]** is not a women-owned business concern.

(End of provision)

5. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (MAR 1996) FAR 52.209-5

(a) (1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are **[ ]** are not **[ ]** presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have **[ ]** have not **[ ]**, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are **[ ]** are not **[ ]** presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision.

(ii) The Offeror has **[ ]** has not **[ ]**, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

6. DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 1994) DFARS 252.209-7001

(a) **Definitions.**

As used in this provision--

(1) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405 (j)(i)(A)), to be a country the government of which has repeatedly provided support for acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means--

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in

"nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) **Prohibition on award.** In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) **Disclosure.** If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include--

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

7. COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (MAR 1998) DFARS 52.209-7003

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (i.e., the VETS-100 report required by Federal Acquisition Regulation clause 52.222-37, Employment Reports on Disabled Veterans and Veterans of the Vietnam Era), it has submitted the most recent report required by 38 U.S.C. 4212(d).

(End of provision)

8. SMALL BUSINESS PROGRAM REPRESENTATIONS (MAY 1999) FAR 52.219-1 (ALTERNATE I) (OCT 1998)

(a) (1) The standard industrial classification (SIC) code for this acquisition is 1542.

(2) The small business size standard is $17.0 million.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) **Representations.** (1) The offeror represents as part of its offer that it **[ ]** is, **[ ]** is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it **[ ]** is, **[ ]** is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it **[ ]** is **[ ]** is not a women-owned small business concern.

(4) (Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision). [The offeror shall check the category in which its ownership falls];

_____ Black American

_____ Hispanic American

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

_____ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

_____ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

_____ Individual/concern, other than one of the preceding.

(c) **Definitions.**

“Small business concern,” as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

“Women-owned small business concern,” as used in this provision, means a small business concern--

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) **Notice.** (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm’s status as a small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under

the preference programs established pursuant to sections 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

9. EQUAL LOW BIDS (OCT 1995) FAR 52.219-2

(a) This provision applies to small business concerns only.

(b) The bidder's status as a labor surplus area (LSA) concern may affect entitlement to award in case of tie bids. If the bidder wishes to be considered for this priority, the bidder must identify, in the following space, the LSA in which the costs to be incurred on account of manufacturing or production (by the bidder or the first-tier subcontractors) amount to more than 50 percent of the contract price.

_____ _____

_____ _____

(c) Failure to identify the labor surplus areas as specified in paragraph (b) of this provision will preclude the bidder from receiving priority consideration. If the bidder is awarded a contract as a result of receiving priority consideration under this provision and would not have otherwise received award, the bidder shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

(End of provision)

10. SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (JAN 1997) FAR 52.219-19

(a) **Definition.** "Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the standard industrial classification code assigned to a contracting opportunity.

(b) **(Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)** The Offeror **[ ]** is, **[ ]** is not an emerging small business.

(c) **(Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)** Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts - see paragraph 11(a) (2) Small Business Program Representations).

(Construction Solicitations)

Number of Employees	Avg. Annual Gross Revenues
_____ 50 or fewer	_____ $1 million or less
_____ 51 - 100	_____ $1,000,001 - $2 million
_____ 101 -250	_____ $2,000,001 - $3.5 million
_____ 251 - 500	_____ $3,500,001 - $5 million
_____ 501 - 750	_____ $5,000,001 - $10 million
_____ 751 - 1,000	_____ $10,000,001 - $17 million
_____ Over 1,000	_____ Over $17 million

(End of provision)

11. PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999) FAR 52.222-22

The offeror represents that--

(a) It **[ ]** has **[ ]** has not, participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) It **[ ]** has, **[ ]** has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of Provision)

12. CLEAN AIR AND WATER CERTIFICATION (APR 1984) FAR 52.223-1

The Offeror certifies that--

(a) Any facility to be used in the performance of this proposed contract **[ ]** is, **[ ]** is not listed on the Environmental Protection Agency (EPA) List of Violating Facilities;

(b) The Offeror will immediately notify the Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the EPA, indicating that any facility that the Offeror proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(c) The Offeror will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

(End of Provision)

13. RECOVERED MATERIAL CERTIFICATION (OCT 1997) FAR 52.223-4

As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C.6962(c)(3)(A)(i)), the offeror certifies, by signing this offer, that the percentage of recovered materials to be used in the performance of the contract will be at least the amount required by the applicable contract specifications.

(End of Provision)

14. CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 1996) FAR 52.223-13

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8,1995.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facilities is exempt for at least one of the following reasons: *(Check each block that is applicable.)*

[ ] (i) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

[ ] (ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

[ ] (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

[ ] (iv) The facility does not fall within the Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in section 19.102 of the Federal Acquisition Regulation; or

[ ] (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(End of provision)

(End of Section 00605)

SECTION 00700

INDEX OF CONTRACT CLAUSES (CONSTRUCTION)
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1. CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991) DFARS 252.201-7000

(a) *Definition*. "Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the Contracting Officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a Contracting Officer's Representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the Contracting Officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

2. DEFINITIONS (OCT 1995)--ALTERNATE I (APR 1984) FAR 52.202-1 I

(a) "Head of the agency" (also called "agency head") or "Secretary" means the Secretary (or Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, including any deputy or assistant chief official of the agency; and the term "authorized representative" means any person, persons, or board (other than the Contracting Officer) authorized to act for the head of the agency or Secretary.

(b) "Commercial component" means any component that is a commercial item.

(c) "Component" means any item supplied to the Federal Government as part of an end item or of another component.

(d) "Nondevelopmental item" means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (d)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (d)(1) or (d)(2) solely because the item is not yet in use.

(e) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

(End of clause)

3. GRATUITIES (APR 1984) FAR 52.203-3

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

4. COVENANT AGAINST CONTINGENT FEES (APR 1984) FAR 52.203-5

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annual this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract or any basis other than the merits of the matter.

(End of clause)

5. ANTI-KICKBACK PROCEDURES (JUL 1995) FAR 52.203-7

(a) *Definitions*.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment or services of any kind.

"Prime Contractor" as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from--

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold from sums owed a subcontractor under the prime contract the amount of the kickback. The Contracting Officer may order that monies withheld under subdivision (c)(4)(ii) of this clause be paid to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed $100,000.

(End of clause)

6. CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-8

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub.L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27 (a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e) (1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

7. PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-10

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27(a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation. In the case of a contract modification, the fee subject to reduction is the fee specified in the particular contract modification at the time of execution, except as provided in subparagraph (b)(5) of this clause.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or “fee floor” specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) For base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract.

The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

8. LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 1997) FAR 52.203-12

(a) *Definitions.*

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

(1) The awarding of any Federal contract.

(2) The making of any Federal grant.

(3) The making of any Federal loan.

(4) The entering into of any cooperative agreement.

(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

(1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.

(2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.

(3) A special Government employee, as defined in section 202, title 18, United States Code.

(4) An individual who is a member of a Federal advisory committee, as defined by the Federal advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) *Prohibitions*.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) *Agency and legislative liaison by own employees*.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) *Professional and technical services*.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal

action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance of operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of this or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) *Disclosure*.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of $25,000 or more in the amount paid or expected to be paid for influencing are attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempting to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding $100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the

calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) *Agreement*. The Contractor agrees not to make any payment prohibited by this clause.

(e) *Penalties*.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) *Cost allowability*. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

9. **PROHIBITION ON PERSONS CONVICTED OF FRAUD OR OTHER DEFENSE-CONTRACT-RELATED FELONIES (MAR 1999) DFARS 252.203-7001**

(a) *Definitions*. As used in this clause--

(1) "Arising out of a contract with the DoD" means any act in connection with--

(i) Attempting to obtain;

(ii) Obtaining; or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of *nolo contendere*, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) Any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from serving-

(1) In a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) On the board of directors of any DoD contractor or first-tier subcontractor;

(3) As a consultant, agent, or representative for any DoD contractor or first-tier subcontractor; or

(4) In any other capacity with the authority to influence, advise, or control the decisions of any DoD contractor or subcontractor with regard to any DoD contract or first-tier subcontract.

(c) Unless waived, the prohibition in paragraph (b) of this clause applies for not less than 5 years from the date of conviction.

(d) 10 U.S.C. 2408 further provides that a defense contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than $500,000 if convicted of knowingly--

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(c) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as--

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibition in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify--

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver, and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identify and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in part 12 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Federal Benefits Office, U.S. Department of Justice, telephone (202) 616-3507.

(End of clause)

10. DISPLAY OF DOD HOTLINE POSTER (DEC 1991) DFARS 252.203-7002

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(c) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

11. PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (JUN 1996) FAR 52.204-4

(a) In accordance with Executive Order 12873, dated October 20, 1993, as amended by Executive Order 12995, dated March 25, 1996, the Offeror/Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed/copied double-sided on recycled paper that has at least 20 percent postconsumer material.

(b) The 20 percent standard applies to high-speed copier paper offset paper, forms bond, computer printout paper, carbonless paper, file folders, white woven envelopes, and other uncoated printed and writing paper such as writing and office paper, book paper, cotton fiber paper, and cover stock. An alternative to meeting the 20 percent postconsumer material standards is 50 percent recovered material content of certain industrial by-products.

(End of clause)

12. REQUIRED CENTRAL CONTRACTOR REGISTRATION (MAR 1998) DFARS 52.204-7004

(a) Definitions. As used in this clause—

(1) Central Contractor Registration (CCR) database means the primary DoD repository for contractor information required for the conduct of business with DoD.

(2) Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(3) Data Universal Numbering System+4 (DUNS+4) number means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.

(4) Registered in the CCR database means that all mandatory information including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b) (1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during the performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offer ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after

initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at http://ccr.edi.disa.mil.

(End of clause)

13. PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS (DEC 1991) DFARS 252.205-7000

(a) *Definition*.

"Cooperative agreement holder" means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450(c)); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e)) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

14. PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995) FAR 52.209-6

(a) The Government suspends or debars Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of $25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed $25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reasons(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interest when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

15. DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990) FAR 52.211-15

NOTE: This clause applies only to military contracts.

This is a rated order certified for national defense use, and the contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700).

(End of clause)

16. VARIATION IN ESTIMATED QUANTITY (APR 1984) FAR 52.211-18

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgment of the Contracting Officer, is justified.

(End of clause)

17. AUDIT AND RECORDS--SEALED BIDDING (OCT 1997) FAR 52.214-26

NOTE: This clause applies only to sealed bid contracts.

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) *Cost or pricing data*. If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

(1) The proposal for the modification;

(2) The discussions conducted on the proposal(s), including those related to negotiating;

(3) Pricing of the modification; or

(4) Performance of the modification.

(c) *Comptroller General*. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) *Availability*. The Contractor shall make available at its office at all reasonable times the materials described in paragraph (b) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

(End of clause)

18. PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS--SEALED BIDDING (OCT 1997) FAR 52.214-27

NOTE: This clause applies only to sealed bid contracts

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.403-1(b) applies.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the

Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) of this clause.

(c) Any reduction in the contract price under paragraph (b) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) the actual subcontract or (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data has been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621 (a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

19. SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS-SEALED BIDDING (OCT 1997) FAR 52.214-28

NOTE: This clause applies only to sealed bid contracts.

(a) The requirements of paragraphs (b) and (c) of this clause shall (1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), and (2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specified identification in writing), unless an exception under FAR 15.403-1(b) applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

(End of clause)

20. AUDIT AND RECORDS--NEGOTIATION (JUN 1999) FAR 52.215-2

NOTE: This clause applies only to negotiated contracts.

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) *Examination of costs*. If this is a cost-reimbursement, incentive, time-and-materials, labor-hour, or price redeterminable contract, or any combination of these, the Contractor shall maintain and the Contracting Officer, or an authorized representative of the Contracting Officer, shall have the right to examine and audit all records and other evidence sufficient to reflect properly all costs claimed to have been incurred or anticipated to be incurred directly or indirectly in performance of this contract. This right of examination shall include inspection at all reasonable times of the Contractor's plants, or parts of them, engaged in performing the contract.

(c) *Cost or pricing data*. If the Contractor has been required to submit cost or pricing data in connection with any pricing action relating to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

(1) The proposal for the contract, subcontract, or modification;

(2) The discussions conducted on the proposal(s), including those related to negotiating;

(3) Pricing of the contract, subcontract, or modification; or

(4) Performance of the contract, subcontract or modification.

(d) *Comptroller General*.--(1) The Comptroller General of the United States, or an authorized representative, shall have access to and the right to examine any of the Contractor's directly pertinent records involving transactions related to this contract or a subcontract hereunder.

(2) This paragraph may not be construed to require the Contractor or subcontractor to create or maintain any record that the Contractor or subcontractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) *Reports*. If the Contractor is required to furnish cost, funding, or performance reports, the Contracting Officer or an authorized representative of the Contracting Officer shall have the right to examine and audit the supporting records and materials, for the purpose of evaluating (1) the effectiveness of the Contractor's policies and procedures to produce data compatible with the objectives of these reports and (2) the data reported.

(f) *Availability*. The Contractor shall make available at its office at all reasonable times the records, materials, and other evidence described in paragraphs (a), (b), (c), (d), and (e) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract, or for any shorter period specified in Subpart 4.7, Contractor Records Retention, of the Federal Acquisition Regulation (FAR), or for any longer period required by statute or by other clauses of this contract. In addition--

(1) If this contract is completely or partially terminated, the Contractor shall make available the records relating to the work terminated until 3 years after any resulting final termination settlement; and

(2) The Contractor shall make available records relating to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to this contract until such appeals, litigation, or claims are finally resolved.

(g) The Contractor shall insert a clause containing all the terms of this clause, including this paragraph (g), in all subcontracts under this contract that exceed the simplified acquisition threshold, and--

(1) That are cost-reimbursement, incentive, time-and-materials, labor-hour, or price-redeterminable type or any combination of these;

(2) For which cost or pricing data are required; or

(3) That require the subcontractor to furnish reports as discussed in paragraph (c) of this clause.

The clause may be altered only as necessary to identify properly the contracting parties and the Contracting Officer under the Government prime contract.

(End of clause)

21. PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA (OCT 1997) FAR 52.215-10

NOTE: This clause applies only to negotiated contracts.

(a) If any price, including profit or fee, negotiated in connection with this contract, or any cost reimbursable under this contract, was increased by any significant amount because --(1) The Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data; (2) A subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) Any of these parties furnished data of any description that were not accurate, the price or cost shall be reduced accordingly and the contract shall be modified to reflect the reduction.

(b) Any reduction in the contract price under paragraph (a) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) The actual subcontract; or (2) The actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(c)(1) If the Contracting Officer determines under paragraph (a) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (c)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the "as of" date specified on its Certificate of Current Cost or Pricing Data, and that the data were not submitted before such date

(ii) An offset shall not be allowed if--

(A) The understated data was known by the Contractor to be understated before the "as of" date specified on its Certificate of Current Cost or Pricing Data; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data has been submitted before the "as of" date specified on its Certificate of Current Cost or Pricing Data.

(d) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable under payment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

22. SUBCONTRACTOR COST OR PRICING DATA (OCT 1997) FAR 52.215-12

NOTE: This clause applies only to negotiated contracts.

(a) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1 applies.

(b) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (a) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(c) In each subcontract that exceeds the threshold for submission of cost or pricing data at FAR 15.403-4, when entered into, the Contractor shall insert either--

(1) The substance of this clause, including this paragraph (c), if paragraph (a) of this clause requires submission of cost or pricing data for the subcontract; or

(2) The substance of the clause at FAR 52.215-13, Subcontractor Cost or Pricing Data--Modifications.

(End of clause)

23. PENSION ADJUSTMENTS AND ASSET REVERSIONS (DEC 1998) FAR 52.215-15

NOTE: This clause applies only to negotiated contracts.

(a) The Contractor shall promptly notify the Contracting Officer in writing when it determines that it will terminate a defined-benefit pension plan or otherwise recapture such pension fund assets.

(b) For segment closings, pension plan terminations, or curtailment of benefits, the adjustment amount shall be the amount measured, assigned, and allocated in accordance with 48 CFR 9904.413-50(c)(12) for contracts and subcontracts that are subject to Cost Accounting Standards (CAS) Board rules and regulations (48 CFR Chapter 99). For contracts and subcontracts that are not subject to CAS, the adjustment amount shall be the amount measured, assigned, and allocated in accordance with 48 CFR 9904.413-50(c)(12), except the numerator of the fraction at 48 CFR 9904.413- 50(c)(12)(vi) shall be the sum of the pension plan costs allocated to all non-CAS-covered contracts and subcontracts that are subject to Federal Acquisition Regulation (FAR) Subpart 31.2 or for which cost or pricing data were submitted.

(c) For all other situations where assets revert to the Contractor, or such assets are constructively received by it for any reason, the Contractor shall, at the Government's option, make a refund or give a credit to the Government for its equitable share of the gross amount withdrawn. The Government's equitable share shall reflect the Government's participation in pension costs through those contracts for which cost or pricing data were submitted or that are subject to FAR Subpart 31.2.

(d) The Contractor shall include the substance of this clause in all subcontracts under this contract that meet the applicability requirement of FAR 15.408(g).

(End of clause)

24. REVERSION OR ADJUSTMENT OF PLANS FOR POSTRETIREMENT BENEFITS (PRB) OTHER THAN PENSIONS (OCT 1997) FAR 52.215-18

NOTE: This clause applies only to negotiated contracts.

The Contractor shall promptly notify the Contracting Officer in writing when it determines that it will terminate or reduce a PRB plan. If PRB fund assets revert, or inure, to the Contractor or are constructively received by it under a plan termination or otherwise, the Contractor shall make a refund or give a credit to the Government for its equitable share as required by FAR 31.205-6(o)(6). The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirements of FAR 15.408(j)

(End of clause)

25. NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997) FAR 52.215-19

NOTE: This clause applies only to negotiated contracts.

(a) The Contractor shall make the following notifications in writing:

(1) When the Contractor becomes aware that a change in its ownership has occurred, or is certain to occur, which could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify the Administrative Contracting Officer (ACO) within 30 days.

(2) The Contractor shall also notify the ACO within 30 days whenever changes to asset valuations or any other cost changes have occurred or are certain to occur as a result of a change in ownership.

(b) The Contractor shall-- (1) Maintain current, accurate, and complete inventory records of assets and their costs; (2) Provide the ACO or designated representative ready access to the records upon request; (3) Ensure that all individual and grouped assets, their capitalized values, accumulated depreciation or amortization, and remaining useful lives are identified accurately before and after each of the Contractor's ownership changes; and (4) Retain and continue to maintain depreciation and amortization schedules based on the asset records maintained before each Contractor ownership change.

(c) The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirement of FAR 15.408(k).

(End of clause)

26. PRICING ADJUSTMENTS (DEC 1991) DFARS 252.215-7000

NOTE: This clause applies only to negotiated contracts.

The term "pricing adjustment," as used in paragraph (a) of the clauses entitled "Price Reduction for Defective Cost or Pricing Data - Modifications," "Subcontractor Cost or Pricing Data," and "Subcontractor Cost or Pricing Data - Modifications," means the aggregate increases and/or decreases in cost plus applicable profits.

(End of clause)

27. UTILIZATION OF SMALL BUSINESS CONCERNS (JUN 1999) FAR 52.219-8

(a) It is the policy of the United States that small business concerns, HUBZone small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, HUBZone small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

(c) Definitions. As used in this contract—

(1) "Small business concern" means a small business as defined pursuant to section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

(2) HUBZone small business concern means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(3) Small business concerns owned and controlled by socially and economically disadvantaged individuals means a small business concern that represents as part of its offer, that it meets the definition of a small disadvantaged business concern in 13 CFR 124.1002.

(4) "Small business concern owned and controlled by women" means a small business concern –

(i) Which is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(ii) Whose management and daily business operations are controlled by one or more women.

(d)Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a HUBZone small business concern, a small business concern owned and controlled by socially and economically disadvantaged individuals or a small business concern owned and controlled by women.

(End of clause)

28. SMALL BUSINES SUBCONTRACTING PLAN (JAN 1999) FAR 52.219-9

NOTE: This clause applies to negotiated solicitations over $1,000,000.00. See also FAR 52.219-9 II below

(a) This clause does not apply to small business concerns.

(b) Definitions. As used in this clause—

"Commercial item" means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

"Commercial plan" means a subcontracting plan (including goals) that covers the offeror's fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

"Individual contract plan" means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror's planned subcontracting in support of the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

"Master plan" means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

"Subcontract" means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The offeror, upon request by the Contracting Officer, shall submit and negotiate a subcontracting plan, where applicable, which separately addresses subcontracting with small business, HUBZone small business, with small disadvantaged business, and with women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate the subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to HUBZone small business concerns;

(iv) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(v) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to—

(i) Small business concerns;

(ii) HUBZone small business concerns;

(iii) Small disadvantaged business concerns; and

(iv) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), the list of certified small disadvantaged business concerns of the SBA, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small and women-owned small business source list. A firm shall rely on the information contained in SBA's list of small disadvantaged business concerns as an accurate representation of a concern's size and ownership characteristics for the purpose of maintaining a small disadvantaged business source list. Use of PRO-Net and/or the SBA list of small disadvantaged business concerns as its source lists does

not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with—

(i) Small business concerns;

(ii) HUBZone small business concerns;

(iii) Small disadvantaged business concerns; and

(iv) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will—

(i) Cooperate in any studies or surveys as may be required;

(ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;

(iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms or as provided in agency regulations and in paragraph (j) of this clause; and

(iv) Ensure that its subcontractors agree to submit SF 294 and 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating—

(A) Whether small business concerns were solicited and if not, why not;

(B) Whether HUBZone small business concerns were solicited and, if not why not;

(C) Whether small disadvantaged business concerns were solicited and if not, why not,

(D) Whether women-owned small business concerns were solicited and if not, why not; and

(E) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact –

(A) Trade associations;

(B) Business development organizations; and

(C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through—

(A) Workshops, seminars, training, etc., and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need to comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, HUBZone small business, small disadvantaged business and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business,

HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small business, HUBZone small business, small disadvantaged business, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided—

(1) The master plan has been approved

(2) The offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer; and

(3) Goals and any deviations from the master plan deemed necessary by the Contacting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial shall plan relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with –

(1) The clause of this contract entitled "Utilization of Small Business Concerns;" or

(2) An approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) Standard Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) Standard Form 295, Summary Subcontract Report. This report encompasses all the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor's format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by Standard Industrial Classification (SIC) Major Group. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant SIC Major Group and report all awards to that subcontractor under its predominant SIC Major Group.

(End of clause)

29. SMALL BUSINESS SUBCONTRACTING PLAN (JAN 1999) ALTERNATE I (JAN 1999) FAR 52.219-9 I

NOTE: This clause applies only to sealed-bid solicitations over $1,000,000.00.

(a) This clause does not apply to small business concerns.

(b) Definitions. As used in this clause—

"Commercial item" means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

"Commercial plan" means a subcontracting plan (including goals) that covers the offeror's fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

"Individual contract plan" means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror's planned subcontracting in support of

the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

"Master plan" means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

"Subcontract" means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The apparent low bidder, upon request by the Contracting Officer, shall submit a subcontracting plan, where applicable, which separately addresses subcontracting with small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns. If the bidder is submitting an individual contract plan, the plan must separately address subcontracting with small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be submitted within the time specified by the Contracting Officer. Failure to submit the subcontracting plan shall make the bidder ineligible for the award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, HUBZone small business, small disadvantaged business and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontractor to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to HUBZone small business concerns;

(iv) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(v) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to—

(i) Small business concerns;

(ii) HUBZone small business concerns;

(iii) Small disadvantaged business concerns; and

(iv) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), the list of certified small disadvantaged business concerns of the SBA, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small and women-owned small business source list. A firm shall rely on the information contained in SBA's list of small disadvantaged business concerns as an accurate representation of a concern's size and ownership characteristics for the purpose of maintaining a small disadvantaged business source list. Use of PRO-Net and/or the SBA list of small disadvantaged business concerns as its source lists does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with—

(i) Small business concerns;

(ii) HUBZone small business concerns;

(iii) Small disadvantaged business concerns; and

(iv) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will—

(i) Cooperate in any studies or surveys as may be required;

(ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;

(iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms or as provided in agency regulations and in paragraph (j) of this clause; and

(iv) Ensure that its subcontractors agree to submit SF 294 and 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating –

(A) Whether small business concerns were solicited and if not, why not;

(B) Whether HUBZone small business concerns were solicited and, if not, why not;

(C) Whether small disadvantaged business concerns were solicited and if not, why not;

(D) Whether women-owned small business concerns were solicited and if not, why not; and

(E) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact –

(A) Trade associations;

(B) Business development organizations; and

(C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through –

(A)Workshops, seminars, training, etc., and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small business, HUBZone small business, small disadvantaged business, or women-owned small business for the

purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided—

(1) The master plan has been approved

(2) The offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer; and

(3) Goals and any deviations from the master plan deemed necessary by the Contacting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial shall plan relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with –

(1) The clause of this contract entitled "Utilization of Small Business Concerns," or

(2) An approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) Standard Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) Standard Form 295, Summary Subcontract Report. This report encompasses all the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor's format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by Standard Industrial Classification (SIC) Major Group. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant SIC Major Group and report all awards to that subcontractor under its predominant SIC Major Group.

(End of clause)

30. SMALL BUSINESS SUBCONTRACTING PLAN (JAN 1999) ALTERNATE II (JAN 1999) FAR 52.219-9 II

NOTE: This clause applies only to negotiated solicitations over $1,000,000, when a subcontracting plan is required with the initial proposal as described in Sections 00110 & 00115.

(a) This clause does not apply to small business concerns.

(b) Definitions. As used in this clause—

"Commercial item" means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

"Commercial plan" means a subcontracting plan (including goals) that covers the offeror's fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

"Individual contract plan" means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror's planned subcontracting in support of the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

"Master plan" means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

"Subcontract" means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) Proposals submitted in response to this solicitation shall include a subcontracting plan, which separately addresses subcontracting with small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate a subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to HUBZone small business concerns;

(iv) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(v) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to—

(i) Small business concerns;

(ii) HUBZone small business concerns;

(iii) Small disadvantaged business concerns; and

(iv) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net of the Small Business Administration (SBA), the list of certified small disadvantaged business concerns of the SBA, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small business, HUBZone small, small disadvantaged, and women-owned small business concerns trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small and women-owned small business source list. A firm shall rely on the information contained in SBA's list of small disadvantaged business concerns as an accurate representation of a concern's size and ownership characteristics for the purpose of maintaining a small disadvantaged business source list. Use of PRO-Net and/or the SBA list of small disadvantaged business concerns as its source lists does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with –

(i) Small business concerns,

(ii) HUBZone small business concerns;

(iii) Small disadvantaged business concerns, and

(iv) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of $500,000 ($1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will—

(i) Cooperate in any studies or surveys as may be required;

(ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;

(iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms or as provided in agency regulations and in paragraph (j) of this clause; and

(iv) Ensure that its subcontractors agree to submit SF 294 and 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, HUBZone small business, small disadvantaged business, d and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than $100,000, indicating—

(A) Whether small business concerns were solicited and if not, why not,

(B) Whether HUBZone small business concerns were solicited and, if not, why not;

(C) Whether small disadvantaged business concerns were solicited and if not, why not,

(D) Whether women-owned small business concerns were solicited and if not, why not, and

(E) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact—

(A) Trade associations,

(B) Business development organizations, and

(C) conferences and trade fairs to locate small business, HUBZone small business, small disadvantaged business, and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through –

(A) Workshops, seminars, training, etc., and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small business, HUBZone small business, small disadvantaged business, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided—

(1) The master plan has been approved;

(2) The offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer; and

(3) Goals and any deviations from the master plan deemed necessary by the Contacting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial shall plan relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with –

(1) The clause of this contract entitled "Utilization of Small Business Concerns," or

(2) An approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) Standard Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) Standard Form 295, Summary Subcontract Report. This report encompasses all the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor's format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by Standard Industrial Classification (SIC) Major Group. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant SIC Major Group and report all awards to that subcontractor under its predominant SIC Major Group.

(End of clause)

31. LIMITATIONS ON SUBCONTRACTING (DEC 1996) FAR 52.219-14

NOTE: This clause applies only if the contract, or any portion of the contract is set-aside for small business or set-aside for the 8(a) program.

(a) This clause does not apply to the unrestricted portion of a partial set-aside.

(b) By submission of an offer and execution of a contract, the Offeror/Contractor agrees that in performance of the contract in the case of a contract for--

(1) *Services (except construction)*. At least 50 percent of the cost of contract performance incurred for personnel shall be expended for employees of the concern.

(2) *Supplies (other than procurement from a nonmanufacturer of such supplies)*. The concern shall perform work for at least 50 percent of the cost of manufacturing the supplies, not including the cost of materials.

(3) *General construction*. The concern will perform at least 15 percent of the cost of the contract, not including the cost of materials, with its own employees.

(4) *Construction by special trade contractors*. The concern will perform at least 25 percent of the cost of the contract, not including the cost of materials, with its own employees.

(End of clause)

32. LIQUIDATED DAMAGES--SUBCONTRACTING PLAN (JAN 1999) FAR 52.219-16

(a) "Failure to make a good faith effort to comply with the subcontracting plan", as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) Performance shall be measured by applying the percentage goals to the total actual subcontracting dollars or, if a commercial plan is involved, to the pro rata share of actual subcontracting dollars attributable to Government contracts covered by the commercial plan. If, at contract completion, or in the case of a commercial product plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply, shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal or, in the case of a commercial products plan, that portion of the dollar amount allocable to Government contracts by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made and to discuss the matter. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial plans, the Contracting Officer approved the plan will perform the functions of the Contracting Officer under this clause on behalf of all agencies that awarded contracts covered by that commercial product plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled, Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

33. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DoD CONTRACTS) (APR 1996) DFARS 252.219-7003

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) *Definitions*.

"Historically black colleges and universities," as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR Section 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

"Minority institutions," as used in this clause, means institutions meeting the requirement of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in Section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term "small disadvantaged business," when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protégé Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(1) Protégé firms which are qualified organizations employing the severely handicapped; and

(2) Former protégé firms that meet the criteria in Section 831(g)(4) of Pub. L. 101-510.

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

34. NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997) FAR 52.222-1

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediate give notice, including all relevant information, to the Contracting Officer.

(End of clause)

35 CONVICT LABOR (AUG 1996) FAR 52.222-3

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

(a) (1) The worker is paid or is in an approved work training program on a voluntary basis;

(2) Representatives of local union central bodies or similar labor union organizations have been consulted;

(3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services;

(4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

36. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME COMPENSATION (JUL 1995) FAR 52.222-4

(a) *Overtime requirements*. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics (see Federal Acquisition Regulation (FAR) 22.300) shall require or permit any such laborers or mechanics in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than 1-1/2 times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(b) *Violation; liability for unpaid wages; liquidated damages*. In the event of any violation of the provisions set forth in paragraph (a) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanical employed in violation of the provisions set forth in paragraph (a) of this clause in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in paragraph (a) of this clause.

(c) *Withholding for unpaid wages and liquidated damages*. The Contracting Officer shall upon his or her own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same Prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in paragraph (b) of this clause.

(d) *Payrolls and basic records*. (1) The Contractor or subcontractor shall maintain payrolls and basic payroll records during the course of contract work and shall preserve them for a period of 3 years from the completion of the contract for all laborers and mechanics working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Nothing in this paragraph shall require the duplication of records required to be maintained for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The records to be maintained under paragraph (d)(1) of this clause shall be made available by the Contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Contracting Officer or the

Department of Labor. The Contractor or subcontractor shall permit such representatives to interview employees during working hours on the job.

(e) *Subcontracts*. The Contractor or subcontractor shall insert in any subcontracts exceeding $100,000 the provisions set forth in paragraphs (a) through (e) of this clause and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the provisions set forth in paragraphs (a) through (e) of this clause.

(End of clause)

37. DAVIS-BACON ACT (FEB 1995) FAR 52.222-6

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approved an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

38. WITHHOLDING OF FUNDS (FEB 1988) FAR 52.222-7

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

39. PAYROLLS AND BASIC RECORDS (FEB 1988) FAR 52.222-8

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents. U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

40. APPRENTICES AND TRAINEES (FEB 1988) FAR 52.222-9

(a) *Apprentices*. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rates) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) *Trainees*. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training

Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) *Equal employment opportunity*. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

41. COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988) FAR 52.222-10

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

42. SUBCONTRACTS (LABOR STANDARDS) (FEB 1988) FAR 52.222-11

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled *Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination--Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility,* and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall delivery to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall delivery to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

43. CONTRACT TERMINATION--DEBARMENT (FEB 1988) FAR 52.222-12

A breach of the contract clauses entitled *Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility*, may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

44. COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988) FAR 52.222-13

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

45. DISPUTES CONCERNING LABOR STANDARDS (FEB 1988) FAR 52.222-14

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or

any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of clause)

46. CERTIFICATION OF ELIGIBILITY (FEB 1988) FAR 52.222-15

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

47. PROHIBITION OF SEGREGATED FACILITIES (FEB 1999) FAR 52.222-21

(a) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex or national origin because of written or oral policies, or employee custom. The term does not include separate or single-user rest rooms and necessary dressing or sleeping areas, which shall be provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

48. EQUAL OPPORTUNITY (FEB 1999) FAR 52.222-26

(a) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of $10,000, the Contractor shall comply with subparagraphs (b)(1) through (11) of this clause. Upon request, the Contractor all provide information necessary to determine the applicability of this clause.

(b) During performance of this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisement for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the contractor has filed within the 12 months preceding the date of contract award, the Contractor shall within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246; as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontract or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the Contracting Officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

49. AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (FEB 1999) FAR 52.222-27

(a) *Definitions*.

"Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin);

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race);

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of $10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors

must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written

record shall be made an maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user restrooms and necessary dressing or sleeping areas shall be provided to assure privacy between sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative actions obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participate may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Make a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as

amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

(o) Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

50. AFFIRMATIVE ACTION FOR DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA (APR 1998) FAR 52.222-35

(a) *Definition.* As used in this clause--.

All employment openings includes all positions except executive and top management, those positions that will be filled from within the contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment.

Appropriate office of the State employment service system, means the local office of the Federal-State national system of public employment offices with assigned responsibility to serve the area where the employment opening is to be filled including the District of Columbia, Guam, the Commonwealth of Puerto Rico, and the Virgin Islands.

Positions that will be filled from within the Contractor's organization means employment openings for which no considered will be given to persons outside the Contractor's organization (including affiliates, subsidiaries, and parent companies) and includes any openings that the Contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a particular opening once an employee decides to consider applicants outside of its organization.

Veteran of the Vietnam era means a person who--

(1) Served on active duty for a period of more than 180 days, any part of which occurred between August 5, 1964, and May 7, 1975, and was discharged or released therefrom with other than a dishonorable discharge; or

(2) Was discharged or released from active duty for a service-connected disability if any part of such active duty was performed between August 5, 1964, and May 7, 1975.

(b) *General*. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against the individual because the individual is a disabled veteran or a veteran of the Vietnam era. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Employment;
(ii) Upgrading;
(iii) Demotion or transfer;
(iv) Recruitment;
(v) Advertising;
(vi) Layoff or termination;
(vii) Rates of pay or other forms of compensation; and
(viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended.

(c) *Listing openings*. (1) The Contractor agrees to list all employment openings existing at contract award or occurring during contract performance, at an appropriate office of the State employment service system in the locality where the opening occurs. These openings include those occurring at any Contractor facility, including one not connected with performing this contract. An independent corporate affiliate is exempt from this requirement.

(2) State and local government agencies holding Federal contracts of $10,000 or more shall also list all employment openings with the appropriate office of the State employment service.

(3) The listing of employment openings with the State employment service system is required at least concurrently with using any other recruitment source or effort and involves the obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(4) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State employment service system, in each State where it has establishments, of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State system, it need not advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(d) *Applicability*. This clause does not apply to the listing of employment openings which occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

(e) *Postings*. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era, and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Act, and is committed to take affirmative action to employ, and advance in employment, qualified disabled veterans and veterans of the Vietnam Era.

(f) *Noncompliance*. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(g) *Subcontracts*. The Contractor shall include the terms of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

51. AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN 1998)
FAR 52.222-36

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as—

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;

(iii) Rates of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor, including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating—

(i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and

(ii) The rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (*e.g.*, the Contractor may have the notice read to a visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical and mental disabilities.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of $10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

52. EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA (JAN 1999) FAR 52.222-37

(a) Unless the Contractor is a State or local government agency, the contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workplace of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled “Federal Contractor Veterans’ Employment Report VETS-100.”

(c) Reports shall be submitted no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending data selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1 of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each contractor subject to the reporting requirements at 38 U.S.C.4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) *Subcontracts*. The Contractor shall include the terms of this clause in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

53. CLEAN AIR AND WATER (APR 1984) FAR 52.223-2

(a) “Air Act,” as used in this clause, means the Clean Air Act (42 U.S.C. 7401 et seq.).

“Clean air standards,” as used in this clause, means--

(1) Any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, work practices, or other requirements contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738;

(2) An applicable implementation plan as described in section 110(d) of the Air Act (42 U.S.C. 7410(d));

(3) An approved implementation procedure or plan under section 111(c) or section 111(d) of the Air Act (42 U.S.C. 7411(c) or (d)); or

(4) An approved implementation procedure under section 112(d) of the Air Act (42 U.S.C. 7412(d)).

"Clean water standards," as used in this clause, means any enforceable limitation, control, condition, prohibition, standard, or other requirement promulgated under the Water Act or contained in a permit issued to a discharger by the EPA or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. 1317).

"Compliance," as used in this clause, means compliance with--

(1) Clean air or water standards; or

(2) A schedule or plan ordered or approved by a court of competent jurisdiction, the EPA, or an air or water pollution control agency under the requirements of the Air Act or Water Act and related regulations.

"Facility," as used in this clause, means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised by a Contractor or subcontractor, used in the performance of a contract or subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the EPA determines that independent facilities are collocated in one geographical area.

"Water Act," as used in this clause, means Clean Water Act (33 U.S.C. 1251 et seq.).

(b) The Contractor agrees--

(1) To comply with the requirements of section 114 of the Clean Air Act (42 U.S.C. 7414) and section 308 of the Clean Water Act (33 U.S.C. 1318) relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, and all regulations and guidelines issued to implement those acts before the award of this contract;

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the EPA List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of the facility from the listing;

(3) To use best efforts to comply with clean air standards and clean water standards at the facility in which the contract is being performed; and

(4) To insert the substance of this clause into any nonexempt subcontract, including this subparagraph (b)(4).

(End of clause)

54. POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998) FAR 52.223-5

(a) Executive Order 12856 of August 3, 1993, requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(b) The Contractor shall provide all information needed by the Federal facility to comply with the emergency planning reporting requirements of Section 302 of EPCRA; the emergency notice requirements of Section 304 of EPCRA; the list of Material Data Safety Sheets required by Section 311 of EPCRA; the emergency and hazardous chemical inventory forms of Section 312 of EPCRA; the toxic chemical release inventory of Section 313 of EPCRA, which includes the reduction and recycling information required by Section 6607 of PPA; and the toxic chemical reduction goals requirements of Section 3-302 of Executive Order 12856.

(End of clause)

55. DRUG-FREE WORKPLACE (JAN 1997) FAR 52.223-6

(a) Definitions. As used in this clause--

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11-1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;.

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

56. CERTIFICATION AND ESTIMATE OF PERCENTAGE OF RECOVERED MATERIAL CONTENT FOR EPA DESIGNATED ITEMS (OCT 1997) FAR 52.223-9

(a) As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C.6962(j)(2)(C)), the Contractor shall execute the following certification:

CERTIFICATION

I, _____ (name of certifier), am an officer or employee responsible for the performance of this contract and hereby certify that the percentage of recovered material content for EPA Designated Items was at least the amount required by the applicable contract specifications.

_____

[Signature of the Officer or Employee

_____
[Typed Name of the Officer or Employee

_____
[Title]

_____
[Name of Company, Firm, or Organization]

_____
[Date]

(End of certification)

(b) The Contractor also shall estimate the percentage of recovered materials actually used in the performance of this contract. The estimate is in addition to the certification in paragraph (a) of this clause.

ESTIMATE

EPA DESIGNATED ITEM	TOTAL DOLLAR VALUE OF EPA DESIGNATED ITEM	PERCENTAGE OF RECOVERED MATERIAL CONTENT
_____	_____	_____
_____	_____	_____
_____	_____	_____

* Where applicable, also include the percent-age of postconsumer material content.

(c) The Contractor shall submit this certification and estimate upon completion of the contract to the Contract Administrator.

(End of Clause)

57. OZONE-DEPLETING SUBSTANCES (JUN 1996) FAR 52.223-11

(a) *Definition*. "Ozone-depleting substance", as used in this clause, means any substance designated as Class I by the Environmental Protection Agency (EPA) (40 CFR Part 82), including but not limited to chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform; or any substance designated as Class II by EPA (40 CFR Part 82), including but not limited to hydrochlorofluorocarbons.

(b) The Contractor shall label products which contain or are manufactured with ozone-depleting substances in the manner and to the extent required by 42 U.S.C. 7671j (b), (c), and (d) and 40 CFR Part 82, Subpart E, as follows:

> ''WARNING: Contains (or manufactured with, if applicable) ____*_____, a substance(s) which harm(s) public health and environment by destroying ozone in the upper atmosphere."
>
> *The Contractor shall insert the name of the substance(s).

(End of clause)

58. TOXIC CHEMICAL RELEASE REPORTING (OCT 1996) FAR 52.223-14

(a) Unless otherwise exempt, the Contractor , as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor

shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023 (b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been file with EPA);

(4) The facility does not fall within the Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in section 19.102 of the Federal Acquisition Regulation (FAR); or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any one of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (I) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed $100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding $100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

59. BUY AMERICAN ACT--CONSTRUCTION MATERIALS (JUN 1997) FAR 52.225-5

NOTE: This clause applies only to contracts less than $6,500,000.

(a) *Definitions*. As used in this clause--

The Buy American Act (41 U.S.C. 10) provides that the Government give preference to domestic construction material.

"Components" means those articles, materials, and supplies incorporated directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the excepted construction material or components listed by the Government as follows: (List will appear in Section H if required.)

(3) Other foreign construction material may be added to the list in paragraph (b)(2) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of he restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(4) The Contractor agrees that only domestic construction material will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(2) of this clause.

(c) *Request for determination*. (1) Contractors requesting to use foreign construction material under paragraph (b)(3) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(3) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration shall be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration shall not be less than the differential established in paragraph (b)(3)(i) of this clause.

(3) If the Government does not determine that an exception of the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

Construction material description	Unit of measure	Quantity	Price (dollars) *
Item 1:			
Foreign construction material			
Domestic construction material			
Item 2:			
Foreign construction material			
Domestic construction material			

List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued.

(End of clause)

60. RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (AUG 1998) FAR 52.225-11

(a) Unless advance written approval of the Contracting Officer is obtained, the Contractor shall not acquire for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States by Executive order or regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries include Cuba, Iran, Iraq, Libya, and North Korea, and Sudan.

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the Government of Iraq.

(c) The Contractor agrees to insert the provisions of this clause, including this paragraph (c), in all subcontracts hereunder.

(End of clause)

61. BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (JUN 1997) FAR 52.225-15

NOTE: This clause applies only to acquisitions with an acquisition value of $7,311,000 or more.

(a) *Definitions*. As used in the clause--

"Components" means those articles, materials, and supplies incorporate directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that—

(1) Is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or

(2) In the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the U.S., if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that—

(1) Is wholly the growth, product, or manufacture of a NAFTA country, or

(2) In the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The Trade Agreements Act and the North American Free Trade Agreement (NAFTA) provide that designated country and NAFTA country construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:

(*If applicable this listing will be placed in Section 00800*)

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, NAFTA country construction materials, or designated country construction materials will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials if any, listed in paragraph (b)(3) of this clause.

(c) *Request for* determination. (1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction materials shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration all be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration all not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

Construction Material Description	Unit of Measure	Quantity	Price (dollars) *
Item 1:			
Foreign construction material	_____	_____	_____
Domestic construction material	_____	_____	_____
Item 2:			
Foreign construction material	_____	_____	_____
Domestic construction material	_____	_____	_____

[List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary.]
[Include other applicable supporting information.]
*[*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate is issued).]*

(End of clause)

62. BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (JUN 1997) ALTERNATE I (MAY 1997) FAR 52.225-15 I

NOTE: This clause applies only to acquisitions with an acquisition value from $6,500,000 to $7,311,000.

(a) *Definitions*. As used in the clause--

"Components" means those articles, materials, and supplies incorporate directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that—

(1) Is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or

(2) In the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the U.S., if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that

(1) Is wholly the growth, product, or manufacture of a NAFTA country, or

(2) In the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The Trade Agreement Act and the North American Free Trade Agreement (NAFTA) provide that designated country and NAFTA country construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:

(*If applicable this listing will be placed in Section 00800*)

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, or NAFTA country construction materials, will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(3) of this clause.

(c) *Request for* determination. (1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction materials shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration all be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration all not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

Construction Material Description	Unit of Measure	Quantity	Price (dollars) *
Item 1:			
Foreign construction material	_____	_____	_____
Domestic construction material	_____	_____	_____
Item 2:			
Foreign construction material	_____	_____	_____
Domestic construction material	_____	_____	_____

[List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary.]
[Include other applicable supporting information.]
*[*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate is issued).]*

(End of clause)

63. SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992) DFARS 252.225-7031

(a) *Definitions*. As used in this clause--

(1) "Foreign person" means any person other than a United States person as defined in Section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).

(2) "United States person" is defined in Section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign concern), and any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern which is controlled in fact by such domestic concern, as determined under regulations of the President.

(b) *Certification*. By submitting this offer, the Offeror, if a foreign person, company or entity, certifies that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel of Arab countries, which 50 U.S.C. App. Sec. 2407(a) prohibits a United States person from taking.

(End of clause)

64. UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (MAY 1999) FAR 52.226-1

(a) For Department of Defense contracts, this clause applies only if the contract includes a subcontracting plan incorporated under the terms of the clause at FAR 52.219-9, Small Business Subcontracting Plan. It does not apply to contracts awarded based on a subcontracting plan submitted and approved under paragraph (g) of the clause at 52.219-9.

(b) *Definitions*. As used in this clause:

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any "Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian-organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indiana tribe for the purposes of 25 U.S.C., chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership shall constitute not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(c) The Contractor agrees to use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the representation of a subcontractor, the Contracting Officer shall refer the matter to the –

U.S. Department of the Interior
Bureau of Indian Affairs (BIA)
Attn: Chief, Division of Contracting and Grants Administration
1849 C Street, NW, MS-334A-SIB
Washington, DC 20245.

The BIA will determine the eligibility and notify the Contracting Officer. The 5 percent incentive payment will not be made within 50 workings days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

(i) The estimated cost of a cost-type contract;

(ii) The target cost of a cost-plus-incentive-fee prime contract;

(iii) The target cost and ceiling price of a fixed price incentive prime contract.

(iv) The price of a firm-fixed-price prime contract.

(3) The amount of the equitable adjustment to the prime contract shall be 5 percent of the estimated cost, target cost, or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(d) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, shall authorize an incentive payment of 5 percent of the amount paid to the subcontractor. The Contracting Officer shall seek funding in accordance with agency procedures. The Contracting Officer's decision is final and not subject to the Dispute clause of this contract.

(End of clause)

65. AUTHORIZATION AND CONSENT (JUL 1995) FAR 52.227-1

(a) The Government authorizes and consents to all use and manufacture, in performing any contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold); however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

(End of clause)

66. PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984) FAR 52.227-4

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

67. RIGHTS IN SHOP DRAWINGS (APR 1966) DFARS 252.227-7033

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail(i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

(End of clause)

68. ADDITIONAL BOND SECURITY (OCT 1997) FAR 52.228-2

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government;

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting Officer has the right to immediately draw on the ILC.

(End of clause)

69. INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997) FAR 52.228-5

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the

effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribed or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

70. PLEDGES OF ASSETS (FEB 1992) FAR 52.228-11

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owner; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

71. PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995) FAR 52.228-12

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

72. FEDERAL, STATE, AND LOCAL TAXES (JAN 1991) FAR 52.229-3

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable, on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceed $250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

73. SUPPLEMENTAL COST PRINCIPLES (DEC 1991) DFARS 52.231-7000

When the allowability of costs under this contract is determined in accordance with Part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with Part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

74. PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (MAY 1997) FAR 52.232-5

(a) *Payment of price*. The Government shall pay the Contractor the contract price as provided in this contract.

(b) *Progress payments*. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the amount included for work performed by each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) *Contractor certification*. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code; and

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

_____
(Name)

_____
(Title)

_____
(Date)

(d) *Refund of unearned amounts*. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) *Retainage*. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) *Title, liability, and reservation of rights*. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) *Reimbursement for bond premiums.* In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) *Final payment.* The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) *Limitation because of undefinitized work.* Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) *Interest computation on unearned accounts.* In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

75. INTEREST (JUNE 1996) FAR 52.232-17

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

76. ASSIGNMENT OF CLAIMS (JAN 1986) ALTERNATE I (APR 1984) FAR 52.232-23 I

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign it rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence. Unless otherwise stated in this contract, payments to an assignee of any amounts due or to become due under this contract shall not, to the extent specified in the Act, be subject to reduction or setoff.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

77. PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (JUN 1997) FAR 52.232-27

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or an electronic funds transfer. Definitions of pertinent terms are set forth in 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see subparagraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) *Invoice Payments*--(1) *Types of invoice payments.* For purposes of this clause, there are several types of invoice payments which may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 14 days after receipt of the payment request by the designated billing office. However, if the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date shall be the 14th day after the date of the Contractor's payment request, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract):

(A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or services completed by the Contractor, whichever is later. If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date shall be deemed to be the 30th day after the date the Contractor's invoice, provided a proper invoice is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) *Contractor's invoice.* The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, it shall be returned within 7 days after the date the designated billing office received the invoice, with a statement of the reasons why it is not a property invoice. Untimely notification will be taken into account in computing any interest penalty owed the Contractor in the manner described in subparagraph (a)(4) of this clause.

(i) Name and address of the Contractor

(ii) Invoice date. (The Contractor is encouraged to date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., prompt payment discount terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to be notified in event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Any other information or documentation required by the contract.

(x) While not required, the Contractor is strongly encouraged to assign an identification number to each invoice.

(3) *Interest penalty.* An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in subdivisions (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment will be made on the following business day without incurring a late payment interest penalty.

(i) A proper invoice was received by the designated billing office.

(ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) *Computing penalty amount.* The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority (e.g., tariffs). This rate is referred to as the "Renegotiation Board Interest Rate," and it is published in the *Federal Register* semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice principal payment amount approved by the Government until the payment date of such approved principal amount, and will be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice principal payment amount and be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraph (a)(2) of this clause, the due date on the corrected invoice will be adjusted by subtracting the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in subdivision (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of the time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected invoice by the Contractor.

(C) For incorrect electronic funds transfer (EFT) information, in accordance with the EFT clause of this contract

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than $1.00 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) *Prompt payment discounts.* An interest penalty shall also be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) *Additional interest penalty.* (i) If this contract was awarded on or after October 1, 1989, a penalty amount, calculated in accordance with subdivision (a)(6)(iii) of this clause, shall be paid in addition to the interest penalty amount if the Contractor--

(A) Is owed an interest penalty of $1 or more;

(B) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(C) Makes a written demand to the designated payment office for additional penalty payment, in accordance with subdivision (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii) (A) Contractors shall support written demands for additional penalty payments with the following data. No additional data shall be required. Contractors shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) Demands may be postmarked on or before the 40th day after payment was made, except that--

(1) If the postmarked is illegible or nonexistent, the demand must have been received and annotated with the date of receipt by the designated payment office on or before the 40th day after payment was made; or

(2) If the postmark is illegible or nonexistent and the designated payment office fails to make the required annotation, the demand's validity will be determined by the date the Contractor has placed on the demand; provided such date is no later than the 40th day after payment was made.

(iii) (A) The additional penalty shall be equal to 100 percent of any original late payment, except--

(1) The additional penalty shall not exceed $5,000;

(2) The additional penalty shall never be less than $25; and

(3) No additional penalty is owed if the amount of the underlying interest penalty is less than $1.

(B) If the interest penalty ceases to accrue in accordance with the limits stated in subdivision (a)(4)(iii) of this clause, the amount of the additional penalty shall be calculated on the amount of interest penalty that would have accrue in the absence of these limits, subject to the overall limits on the additional penalty specified in subdivision (a)(6)(iii)(a) of the clause.

(C) For determining the maximum and minimum additional penalties, the test shall be the interest penalty due on each separate payment made for each separate contract. The maximum and minimum additional penalty shall not be based upon individual invoices unless the invoices are paid separately. Where payments are consolidated for disbursing purposes, the maximum and minimum additional penalty determination shall be made separately for each contract therein.

(D) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) *Contract Financing Payments*. (1) *Due dates for recurring financing payments.* If this contract provides for contract financing, requests for payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting Officer. Contract financing payment shall be made on the 30th day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified.

(2) *Due dates for other contract financing.* For advance payments, loans, or other arrangements that do not involve recurring submissions of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer.

(3) *Interest penalty not applicable.* Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) *Subcontract clause requirements.* The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) *Prompt payment for subcontractors.* A payment clause which obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) *Interest for subcontractors.* An interest penalty clause which obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due to made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligations to pay an interest penalty.

(3) *Subcontract clause flowdown* A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its

subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) *Subcontract clause interpretation.* The clauses required by paragraph (c) of this clause shall not be construed to impair the right of Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) *Retainage permitted.* Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and payment bond;

(2) *Withholding permitted.* Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) *Withholding requirements.* Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the Contracting Officer.

(e) *Subcontractor withholding procedures*. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) *Subcontractor notice*. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) *Contracting Officer notice.* Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) *Subcontractor progress payment reduction.* Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) *Subsequent subcontractor payment.* Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under subdivision (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) *Notice to Contracting Officer*. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) *Interest to Government.* Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision (e)(5)(i) of this clause.

(f) *Third-party deficiency reports.* (1) *Withholding from subcontractor*. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) *Subsequent payment or interest charge.* As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall (i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or (ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) *Written notice of subcontractor withholding.* A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) *Subcontractor payment entitlement.* The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) *Prime-subcontractor disputes.* A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) *Preservation of prime-subcontractor rights.* Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) *Non-recourse for prime contractor interest penalty.* The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest penalty. A cost reimbursement claim may not include any amount for reimbursement of such interest penalty.

(End of clause)

78. PAYMENT BY ELECTRONIC FUNDS TRANSFER—CENTRAL CONTRACTOR REGISTRATION (MAY 1999) FAR 52.232-33

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) of this clause. As used in this clause, the term "EFT" refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either –

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (d) of this clause).

(b) Contractor's EFT information. The Government shall make payment to the Contractor using the EFT information contained in the Central Contractor Registration (CCR) database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the CCR database.

(c) Mechanisms for EFT payment. The Government may make payment by EFT through either the Automated Clearing House (ACH) network, subject to the rules of the National Automated Claring House Association, or the Fedwire Transfer System. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) Suspension of payment. If the Contractor's EFT information in the CCR database is incorrect, then the Government need not make payment to the Contractor under this contract until correct EFT information is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(e) Contractor EFT arrangements. If the Contractor has identified multiple payment receiving points (i.e., more than one remittance address or EFT information set) in the CCR database, and the Contractor has not notified the Government

of the payment receiving point applicable to this contract, the Government shall make payment to the first payment receiving point (EFT information set or remittance address as applicable) listed in the CCR database.

(f) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government used the Contractor's EFT information incorrectly, the Government remains responsible for—

(i) Making a correct payment;

(ii) Paying any prompt payment penalty due; and

(iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and—

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (d) of this clause shall apply.

(g) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(h) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee register in the CCR database and be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (d) of this clause.

(j) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information made by the Contractor's financial agent.

(k) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Contractor has certified in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.

(End of clause)

79. DISPUTES (DEC 1998) FAR 52.233-1

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. A claim arising under a contract, unlike a claim relating to that contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph (d)(2) of this clause. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) Contractors shall provide the certification specified in paragraph (d)(2)(iii) of this clause when submitting any claim exceeding $100,000.

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of $100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over $100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative disputes resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the offer.

(h) The government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certification, as defined in FAR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claim shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

80. PROTEST AFTER AWARD (AUG 1996) FAR 52.233-3

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; *provided*, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal submitted at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In

addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

81. DIFFERING SITE CONDITIONS (APR 1984) FAR 52.236-2

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; *provided*, that the time prescribed in paragraph (a) of this clause for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

81. SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984) FAR 52.236-3

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as to this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions that can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

83. MATERIAL AND WORKMANSHIP (APR 1984) FAR 52.236-5

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the

Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide all information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that to not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

84. SUPERINTENDENCE BY THE CONTRACTOR (APR 1984) FAR 52.236-6

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

85. PERMITS AND RESPONSIBILITIES (NOV 1991) FAR 52.236-7

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

86. OTHER CONTRACTS (APR 1984) FAR 52.236-8

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

87. PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984) FAR 52.236-9

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

88. OPERATIONS AND STORAGE AREAS (APR 1984) FAR 52.236-10

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

89. USE AND POSSESSION PRIOR TO COMPLETION (APR 1984) FAR 52.236-11

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

90. CLEANING UP (APR 1984) FAR 52.236-12

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

91. ACCIDENT PREVENTION (NOV 1991)--ALTERNATE I (NOV 1991) FAR 52.236-13 I

(a) The Contractor shall provide and maintain work environments and procedures which will (1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities; (2) avoid interruptions of Government operations and delays in project completion dates; and (3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall--

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(f) Before commencing the work, the Contractor shall--

(1) Submit a written proposed plan for implementing this clause. The plan shall include an analysis of the significant hazards to life, limb, and property inherent in contract work performance and a plan for controlling these hazards; and

(2) Meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

(End of clause)

92. SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984) FAR 52.236-15

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payment until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately delivery three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

93. SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997) FAR 52.236-21

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words “directed”, “required”, “ordered”, “designated”, “prescribed”, or words of like import are used, it shall be understood that the “direction”, “requirement”, “order”, “designation”, or “prescription”, of the Contracting Officer is intended and similarly the words “approved”, “acceptable”, “satisfactory”, or words of like import shall mean “approved by,” or “acceptable to”, or “satisfactory to” the Contracting Officer, unless otherwise expressly stated.

(c) Where “as shown”, “as indicated”, “as detailed”, or words of similar import are used, it shall be understood that reference is made to the drawings accompanying this contract unless stated otherwise. The word “provided” as used herein shall be understood to mean “provide complete in place”, that is furnished and installed”.

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor’s approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government’s reasons therefor. Any work done before such approval shall be at the Contractor’s risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

94. PRECONSTRUCTION CONFERENCE (FEB 1995) FAR 52.236-26

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer’s notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

95. MODIFICATION PROPOSALS--PRICE BREAKDOWN (DEC 1991)
DFARS 252.236-7000

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown--

(1) Must include sufficient detail to permit analysis of profit, and of all costs for--

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor’s proposal shall include a justification for any time extension proposed.

(End of clause)

96. BANKRUPTCY (JUL 1995) FAR 52.242-13

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

97. SUSPENSION OF WORK (APR 1984) FAR 52.242-14

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

98. POSTAWARD CONFERENCE (DEC 1991) DFARS 252.242-7000

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation Subpart 42.5.

(End of clause)

99. CHANGES (AUG 1987) FAR 52.243-4

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

(1) In the specifications (including drawings and designs);

(2) In the method or manner or performance of the work;

(3) In the Government-furnished facilities, equipment, materials, services, or site; or

(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; *provided*, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications

for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

100. PRICING OF CONTRACT MODIFICATIONS (DEC 1991) DFARS 252.243-7001

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR Part 31 and DFARS Part 231, in effect on the date of this contract, apply.

(End of clause)

101. REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998) DFARS 252.243-7002

(a) The amount of any request for equitable adjustment to contract terms shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(b) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

> I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.
>
> _____
> (Official's Name)
>
> _____
> (Title)

(c) The certification in paragraph (b) of this clause requires full disclosure of all relevant facts, including—

(1) Cost or pricing data if required in accordance with subsection 15.403-4 of the Federal Acquisition Regulation (FAR); and

(2) Information other than cost or pricing data, in accordance with subsection 15.403-3 of the FAR, including actual cost data and data to support any estimated costs, even if cost or pricing data are not required.

(d) The certification requirement in paragraph (b) of this clause does not apply to—

(1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or

(2) Final adjustments under an incentive provision of the contract.

(End of clause)

102. GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS) (DEC 1989) FAR 52.245-2

NOTE: This clause applies only when the acquisition cost of all Government-furnished property to be involved in the contract is more than $100,000.

(a) *Government-furnished property*. (1) The Government shall deliver to the Contractor, for use in connection with and under the terms of this contract, the Government-furnished property described in the Schedule or specifications together with any related data and information that the Contractor may request and is reasonably required for the intended use of the property (hereinafter referred to as "Government-furnished property").

(2) The delivery or performance dates for this contract are based upon the expectation that Government-furnished property suitable for use (except for property furnished "as is") will be delivered to the Contractor at the times stated in the Schedule or, if not so stated, in sufficient time to enable the Contractor to meet the contract's delivery or performance dates.

(3) If Government-furnished property is received by the Contractor in a condition not suitable for the intended use, the Contractor shall, upon receipt of it, notify the Contracting Officer, detailing the facts, and, as directed by the Contracting Officer and at Government expense, either repair, modify, return, or otherwise dispose of the property. After completing the directed action and upon written request of the Contractor, the Contracting Officer shall make an equitable adjustment as provided in paragraph (h) of this clause.

(4) If Government-furnished property is not delivered to the Contractor by the required time, the Contracting Officer shall, upon the Contractor's timely written request, make a determination of the delay, if any, caused the Contractor and shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(b) *Changes in Government-furnished property*. (1) The Contracting Officer may, by written notice, (i) decrease the Government-furnished property provided or to be provided under this contract, or (ii) substitute other Government-furnished property for the property to be provided by the Government, or to be acquired by the Contractor for the Government, under this contract. The Contractor shall promptly take such action as the Contracting Officer may direct regarding the removal, shipment, or disposal of the property covered by such notice.

(2) Upon the Contractor's written request, the Contracting Officer shall make an equitable adjustment to the contract in accordance with paragraph (h) of this clause, if the Government has agreed in the Schedule to make the property available for performing this contract and there is any--

(i) Decrease or substitution in this property pursuant to subparagraph (b)(1) above; or

(ii) Withdrawal of authority to use this property, if provided under any other contract or lease.

(c) *Title in Government property*. (1) The Government shall retain title to all Government-furnished property.

(2) All Government-furnished property and all property acquired by the Contractor, title to which vests in the Government under this paragraph (collectively referred to as "Government property"), are subject to the provisions of this clause. However, special tooling accountable to this contract is subject to the provisions of the Special Tooling clause and is not subject to the provisions of this clause. Title to Government property shall not be affected by its incorporation into or attachment to any property not owned by the Government, nor shall Government property become a fixture or lose its identity as personal property by being attached to any real property.

(3) Title to each item of facilities and special test equipment acquired by the Contractor for the Government under this contract shall pass to and vest in the Government when its use in performing this contract commences or when the Government has paid for it, whichever is earlier, whether or not title previously vested in the Government.

(4) If this contract contains a provision directing the Contractor to purchase material for which the Government will reimburse the Contractor as a direct item of cost under this contract--

(i) Title to material purchased from a vendor shall pass to and vest in the Government upon the vendor's delivery of such material; and

(ii) Title to all other material shall pass to and vest in the Government upon--

(A) Issuance of the material for use in contract performance;

(B) Commencement of processing of the material or its use in contract performance; or

(C) Reimbursement of the cost of the material by the Government, whichever occurs first.

(d) *Use of Government property*. The Government property shall be used only for performing this contract, unless otherwise provided in the contract or approved by the Contracting Officer.

(e) *Property administration*. (1) The Contractor shall be responsible and accountable for all Government property provided under this contract and shall comply with Federal Acquisition Regulation (FAR) Subpart 45.5, as in effect on the date of this contract.

(2) The Contractor shall establish and maintain a program for the use, maintenance, repair, protection, and preservation of Government property in accordance with sound industrial practice and the applicable provisions of Subpart 45.5 of the FAR.

(3) If damage occurs to Government property, the risk of which has been assumed by the Government under this contract, the Government shall replace the items or the Contractor shall make such repairs as the Government directs. However, if the Contractor cannot effect such repairs with the time required, the Contractor shall dispose of the property as directed by the Contracting Officer. When any property for which the Government is responsible is replaced or repaired, the Contracting Officer shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(4) The Contractor represents that the contract price does not include any amount for repairs or replacement for which the Government is responsible. Repairs or replacement of property for which the Contractor is responsible shall be accomplished by the Contractor at its own expense.

(f) *Access*. The Government and all its designees shall have access at all reasonable times to the premises in which any Government property is located for the purpose of inspecting the Government property.

(g) *Risk of loss*. Unless otherwise provided in this contract, the Contractor assumes the risk of, and shall be responsible for, any loss or destruction of, or damage to, Government property upon its delivery to the Contractor or upon passage of title to the Government under paragraph (c) of this clause. However, the Contractor is not responsible for reasonable wear and tear to Government property or for Government property properly consumed in performing this contract.

(h) *Equitable adjustment*. When this clause specifies an equitable adjustment, it shall be made to any affected contract provision in accordance with the procedures of the Changes clause. When appropriate, the Contracting Officer may initiate an equitable adjustment in favor of the Government. The right to an equitable adjustment shall be the Contractor's exclusive remedy. The Government shall not be liable to suite for breach of contract for--

(1) Any delay in delivery of Government-furnished property;

(2) Delivery of Government-furnished property in a condition not suitable for its intended use;

(3) A decrease in or substitution of Government-furnished property; or

(4) Failure to repair or replace Government property for which the Government is responsible.

(i) *Final accounting and disposition of Government property* Upon completing this contract, or at such earlier dates as may be fixed by the Contracting Officer, the Contractor shall submit, in a form acceptable to the Contracting Officer, inventory schedules covering all items of Government property (including any resulting scrap) not consumed in performing this contract or delivered to the Government. The Contractor shall prepare for shipment, delivery f.o.b. origin, or dispose of the Government property as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as the Contracting Officer directs.

(j) *Abandonment and restoration of Contractor's premises*. Unless otherwise provided herein, the Government--

(1) May abandon any Government property in place, at which time all obligations of the Government regarding such abandoned property shall cease; and

(2) Has no obligation to restore or rehabilitate the Contractor's premises under any circumstances (e.g., abandonment, disposition upon completion of need, or upon contract completion). However, if the Government-furnished property (listed in the Schedule or specifications) is withdrawn or is unsuitable for the intended use, or if other Government property is substituted, then the equitable adjustment under paragraph (h) of this clause may properly include restoration or rehabilitation costs.

(k) *Communications*. All communications under this clause shall be in writing.

(l) *Overseas contracts*. If this contract is to be performed outside of the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

103 . GOVRNMENT-FURNISHED PROPERTY (SHORT FORM) (APR 1984) FAR 52.245-4

NOTE: This clause applies only when the acquisition cost of all Government-furnished property to be involved in the contract is $100,000 or less.

(a) The Government shall delivery to the Contractor, at the time and locations stated in this contract, the Government-furnished property described in the Schedule or specifications. If that property, suitable for its intended used, is not delivered to the Contractor, the Contracting Officer shall equitably adjust affected provisions of this contract in accordance with the Changes clause when--

(1) The Contractor submits a timely written request for an equitable adjustment; and

(2) The facts warrant an equitable adjustment.

(b) Title to Government-furnished property shall remain in the Government. The Contractor shall use the Government-furnished property only in connection with this contract. The Contractor shall maintain adequate property control records in accordance with sound industrial practice and will make such records available for Government

inspection at all reasonable times, unless the clause at Federal Acquisition Regulation 52.245-1, Property Records, is included in this contract.

(c) Upon delivery of Government-furnished property to the Contractor, the Contractor assumes, the risk and responsibility for its loss or damage, except--

(1) For reasonable wear and tear;

(2) To the extent property is consumed in performing this contract; or

(3) As otherwise provided for by the provisions of this contract.

(d) Upon completing this contract, the Contractor shall follow the instructions of the Contracting Officer regarding the disposition of all Government-furnished property not consumed in performing this contract or previously delivered to the Government. The Contractor shall prepare for shipment, delivery f.o.b. origin, or dispose of the Government property, as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as directed by the Contracting Officer.

(e) If this contract is to be performed outside the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

104. REPORTS OF GOVERNMENT PROPERTY (MAY 1994) DFARS 252.245-7001

(a) The Contractor shall provide an annual report--

(1) For all DoD property for which the Contractor is accountable under the contract;

(2) Prepared in accordance with the requirements of DD Form 1662, DoD Property in the Custody of Contractors, or approved substitute, including instructions on the reverse side of the form;

(3) In duplicate, to the cognizant Government property administrator, no later than October 31.

(b) The Contractor is responsible for reporting all Government property accountable to this contract, including that at subcontractor and alternate locations.

(End of clause)

105. INSPECTION OF CONSTRUCTION (AUG 1996) FAR 52.246-12

(a) *Definition*. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the complete work under paragraph (i) below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

106. VALUE ENGINEERING--CONSTRUCTION (MAR 1989)--ALTERNATE I (APR 1984)
FAR 52.248-3 I

(a) *General*. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) *Definitions*. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP): means a proposal that--

(1) Requires a change to this, the instant contract, to implement; and

(2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; *provided*, that it does not involve a change--

(i) In deliverable end item quantities only; or

(ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for (i) the affected portions of the existing contract requirement and (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A predicting of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) *Submission*. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) *Government action*. (1) The Contracting Officer shall notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer shall notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decisions. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer shall notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The Contracting Officer's decision to accept or reject all or part of any VECP shall be final and not subject to the Disputes clause or otherwise subject to litigation under the Contract Disputes Act of 1978 (41 U.S.C. 601-613).

(f) *Sharing*. (1) *Rates*. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 45 percent for fixed-price contracts or (ii) 75 percent for cost-reimbursement contracts.

(2) *Payment*. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) *Subcontracts*. The Contractor shall include an appropriate value engineering clause in any subcontract of $50,000 or more an may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; *provided*, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(h) *Data*. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

> "These data, furnished under the Value Engineering--Construction clause of contract _____, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

107. TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SEP 1996)--ALTERNATE I (SEP 1996) FAR 52.249-2 I

(a) The Government may terminate performance of the work under this contract in whole or in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and delivery to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; *provided*, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and the Contracting Officer fail to agree on the whole amount to be paid because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is not right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

108. DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984) FAR 52.249-10

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time,

the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God or of the public enemy, (ii) acts of the Government in either its sovereign or contractual capacity, (iii) acts of another Contractor in the performance of a contract with the Government, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

(d) The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

109. COMPUTER GENERATED FORMS (JAN 1991) FAR 52.253-1

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, *provided* the form carries the Standard or Optional Form number and edition data.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition data.

(c) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

END OF SECTION 00700

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25 February 1999

Section 00800

Special Contract Requirements

1. COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK (APR 1984) FAR 52.211-10. The Contractor shall be required to commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, prosecute said work diligently, and complete the entire work ready for use not later than 540 calendar days after date of receipt of notice to proceed. The time stated for completion shall include as-built drawings, O&M manuals, operational tests/reports/training/instructions, equipment lists, and final cleanup of the premises.

2. LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984) FAR 52.211-12.

2.1 If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of $750.00 for each day of delay.

2.2 If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

2.3 If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

3. TIME EXTENSIONS (APR 1984) FAR 52.211-13. Notwithstanding any other provisions of this contract, it is mutually understood that the time extensions for changes in the work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining contract completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages under the new completion schedule.

4. NOT USED.

5. NOT USED.

(2) 6. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS (DEC 1991) DFARS 252.236-7001.

6.1 The Government--

(1) Will furnish the Contractor one set of reproducibles, of half-size drawings.

(2) Drawings and specifications are available in the office of the Corps of Engineers, Department of the Army, Room 821, Dr. Martin Luther King, Jr. Place, Louisville, Kentucky.

6.2 The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies; and

(4) Be responsible for any errors which might have been avoided by complying with paragraph 6.2 (1), (2) and (3).

6.3 Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

6.4 The work shall conform to the specifications and the contract drawings identified on the following index of drawings:

19 October 1987

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7. NOT USED.

8. RIGHTS IN SHOP DRAWINGS (APR 1966) DFARS 252.227-7033.

8.1 Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower tier subcontractor pursuant to a construction contract, showing detail (I) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

8.2 This clause, including this paragraph (8.2), shall be included in all subcontracts hereunder at any tier.

(1)9. AS-BUILT DOCUMENTS

9.1 General: This section covers the completion of as-built drawings and as-built specifications, as a requirement of the contract.

9.1.1 As-Built Drawings:

An as-built drawing is a construction drawing revised to reflect the final as-built conditions of the project as a result of modifications, changes, corrections to the project design required during construction, submittals and extensions of design. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings which are revised to be used for the “RECORD DRAWING AS-BUILTS”.

9.1.2 As-Built Specifications:

As-built specifications are the construction specifications as modified by changes (contract mods, ACO approved variations from the construction specifications which did not result in contract mods).

9.2 Submittals

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

SD-18 Records

As-Built Drawings; [GA].

Drawings showing final as-built conditions of the project. The Microstation drawing submittals shall consist of two (2) separate types of media. One set of media shall consist of the electronic CADD drawing files. The second media type,

shall consist of one set of mylars, 2 sets of blue line prints of the mylars, and the approved marked working as-built prints.

9.3 Procedures

9.3.1 General Discussion

9.3.1.1 Maintenance of Working As-Built Drawings:

The Contractor shall revise 2 sets of paper prints by red-line process to show the as-built conditions during the prosecution of the project. These as-built marked prints shall be kept current on a weekly basis and available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. Changes must be reflected on all sheets affected by the change. The working as-built marked prints will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. The working as-built drawings shall show the following information, but not be limited thereto:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Additional as-built information that exceeds the detail shown on the Contract Drawings. These as-built conditions include those that reflect structural details, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations and layouts, equipment, sizes, mechanical room layouts and other extensions of design, that were not shown in the original contract documents because the exact details were not known until after the time of approved shop drawings. It is recognized that these shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the contract drawings. All such shop drawing submittals must include, along with the hard copy of the drawings, CADD files of the shop drawings in a commercially available digital format, compatible with the Using Agency System (see paragraph 9.3.2). All shop drawings which require submittal of CADD files are indicated in the submittal register located at the end of this section.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

g. If fire protection and fire detection related systems are included in this project, the as-built drawings will include detailed information for all aspects of the systems including wiring, piping, and equipment drawings.

9.3.1.2 The contractor will be provided files at the beginning of construction for use during the construction phase which are to be maintained during construction and for the preparation of as-builts. The Contractor shall enter changes and corrections on blue line prints on a weekly basis in accordance with Paragraph 9.3.1.1 and update the CADD as-built drawings on a monthly basis. Both paper and electronic documents shall be available at all times and shall be provided promptly to the contracting officer when requested. The contractor shall be responsible for backup of electronic files during construction and for controlling release of information.

9.3.1.3 Retainage: The Contractor shall include in his schedule of values, the cost of as-built document preparation. This value shall include all requirements of this clause:

- maintenance of working as-built drawings
- maintenance of working as-built specifications
- conversion of submittals and other miscellaneous documents into electronic files
- creation of “Record As-Built Drawings & Specifications” (either by CADD dwgs and MicroSoft Word specifications or by manually prepared documents as specified herein.)
- creation of a CD containing all required files.
- submittal of as-built documents in the required media forms and numbers of copies

If the Contractor fails to maintain the working as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of bringing the as-built documents up to date. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of working as-built documents.

9.3.1.4 Preliminary Submittal:

Six (6) weeks prior to occupancy of this facility by the Government, the Contractor shall submit one (1) set the original working as-built drawings to the Contracting Officer for review and approval. These working as-built marked drawings shall be neat, legible and accurate. The review by Government personnel will be expedited to the maximum extent possible. Upon approval, the working as-built marked drawings will be returned to the Contractor for use in preparation of final as-built drawings. If upon review, the working as-built marked drawings are found to contain errors and/or omissions, they will be returned to the Contractor for corrections. The Contractor shall complete the corrections and return the working as-built marked drawings to the Contracting Officer within 10 calendar days.

9.3.1.5 Preparation of Final As-Built Drawings:

Upon approval of the working as-built prints submittal, the Contractor will

be furnished, by the Government, one set of contract drawings [in Microstation (if not previously provided) with all amendments incorporated, to be used for final as-built drawings. Any contract modifications which were developed by revision of contract drawing CADD files, will already have the modifications reflected in the files provided to the Contractor. These contract drawings will be furnished in the format specified in paragraph 9.3.2. These drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, adding such additional drawings as may be necessary. These drawings are part of the permanent records of this project and the Contractor shall be responsible for the protection and safety thereof until returned to the Contracting Officer. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

In the event the Contractor accomplishes additional work which changes the as-built conditions of the facility, after submission and approval of the working as-built drawings, he shall be responsible for the addition of these changes to the working as-built drawings and also to the final as-built documents.

9.3.1.6 Markings and Indicators

Changes shall be annotated with a triangle and sequential number at the following locations:

a.bottom of the revised detail

b.right hand and bottom border aligned with the revised detail

c.the revision block of the title block.

Separate markings shall be made for each modification negotiated into the contract.

9.3.1.7 Preparation of Final As-Built Specifications:

Final as-built specifications shall be prepared in MicroSoft Word Version 6.0 and the electronic files shall be placed on the same CD ROM that contains the “As-Built” CADD files, if applicable. The front sheet of the specifications shall contain an identification which clearly labels the specifications as representing as-built conditions and shall be dated with the date of the submittal.

9.3.1.8 Preparation of Other As-Built Documents:

All other non-electronic documents which may include design analysis, catalog cuts, certification documents that are not available in native electronic format shall be scanned and provided in an organized manner in Adobe .pdf format.

9.3.1.9 Submittal of Final As-Built Documents:

At the time of Beneficial Occupancy of the project, Final As-Built documents shall be provided to the Contracting Officer in the formats described in paragraph 9.3.2.

9.3.1.10 Partial Occupancy:

For projects where portions of construction are to be occupied or activated prior to overall project completion, including portions of utility systems, as-built drawings for those portions of the facility being occupied or activated shall be supplied at the time the facility is occupied or activated. This same

as-built information previously furnished must also be shown on the final set of as-built drawings at project completion.

9.3.2 Computer Aided Design and Drafting (CADD) Drawings:

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality to that of the originals. Line work, line weights, lettering, layering conventions, and symbols shall be the same as the original line work, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same guidance specified for original drawings. Three dimensional (3D) elements shall be placed in files in their proper locations when utilizing 3D files with spatially correct elements. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD media files supplied by the Government. All work by the contractor shall be done on files in the format in which they are provided. Translation of files to a different format, for the purpose of As-Built production, and then retranslating back to the format originally provided, will not be acceptable. These contract drawings will already be compatible with the Using Agency's system when received by the Contractor. The Using Agency uses Microstation CADD software system. The media files will be supplied by the Contractor to the COR on Using Agency's specified media. The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make all required corrections, changes, additions, and deletions.

a. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 5 mm 3/16 inch high. All other contract drawings shall be marked either "AS-BUILT" drawing denoting no revisions on the sheet or "REVISED AS-BUILT" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

b. Revision markers defined in paragraph 9.3.1.6 shall be placed as follows:

1. at the detail, placed in the design file where the revised graphics are located and the revision was placed
2. right hand and bottom border in the drawing sheet file
3. revision block of the title block in the drawing sheet file.

c. After receipt by the Contractor of the approved working as-built prints and the original contract drawings files the Contractor shall, within 30 calendar days, make the final as-built submittal. This submittal shall consist of 2 sets of completed final as-built drawings on separate media consisting of both CADD files (compatible with the Using Agency's system on electronic storage media identical to that supplied by the Government) and mylars; 2 blue line prints of these drawings and the return of the approved marked working as-built prints. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with its CADD system. All paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval

and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

9.3.3 Not Used.

9.3.4 Payment:

No separate payment will be made for as-built drawings required under this contract, and all costs in conjunction therewith, shall be considered a subsidiary obligation of the Contractor.

(1) 10. EQUIPMENT DATA.

10.1 Real Property Equipment. The Contractor shall be required to make a list of all installed equipment furnished under this contract. This list shall include all information usually listed on manufacturer's name plate. The form is part of SPECIAL CONTRACT REQUIREMENTS and is included following the SPECIAL CONTRACT REQUIREMENTS, so to positively identify the piece of property. The list shall also include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, the following information shall be given: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. The list shall be furnished as one (1) reproducible and three (3) copies and shall be furnished to the Contracting Officer not later than thirty (30) calendar days prior to completion of any segment of the contract work which has an incremental completion date.

10.2 Maintenance and Parts Data. The Contractor will be required to furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication which will show detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph 10.1.

11. PHYSICAL DATA (APR 1984) FAR 52.236-4. Data and information furnished or referred to below are furnished for the Contractor's information. The Government will not be responsible for any interpretation or conclusion drawn from the data or information by the Contractor.

11.1 Physical Conditions indicated on the drawings and in the specifications are the result of site investigations.

11.2 Weather Conditions. The Contractor shall make his own investigations as to weather conditions at the site. Data may be obtained from various National Weather Service offices located generally at airports of principal cities, the nearest to this project being:

Logan Airport
Boston, MA

Historical data for all areas may be obtained from:

U. S. Department of Commerce
National Climatic Center
Federal Building
Asheville, N. C. 28801

11.3 Transportation Facilities. Roads and railroads in the general area are shown on the drawings. Access ways shall be investigated by the Contractor to satisfy himself as to their existence and allowable use.

11.4 Not Used.

12. UTILITIES (APR 1984) FAR 52.236-14 (Para. 12.1.1 & 12.1.2 only).

12.1 Availability and Use of Utility Services.

12.1.1 The Government will make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

12.1.2 The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

12.2 Alterations to Utilities. Where changes and relocations of utility lines are noted to be performed by others, the Contractor shall give the Contracting Officer at least thirty (30) days written notice in advance of the time that the change or relocation is required. The Contractor is responsible for coordinating any and all work to be accomplished by others. In the event that, after the expiration of thirty (30) days after the receipt of such notice by the Contracting Officer, such utility lines have not been changed or relocated and delay is occasioned to the completion of the work under contract, the Contractor will be entitled to a time extension equal to the period of time lost by the Contractor after the expiration of said thirty (30) day period. Any modification to existing or relocated lines required as a result of the Contractor's method of operation shall be made wholly at the Contractor's expense and no additional time will be allowed for delays incurred by such modifications.

12.3 Interruptions of Utilities:

12.3.1 No utility services shall be interrupted by the Contractor to make connections, to relocate, or for any purpose without approval of the Contracting Officer.

12.3.2 Request for Permission to shut down services shall be submitted in writing to the Contracting Officer not less than seventeen (17) days prior to date of proposed interruption. The request shall give the following information:

(1) Nature of Utility (Gas, L.P. or H.P., Water, etc.)

(2) Size of line and location of shutoff.

(3) Buildings and services affected.

(4) Hours and date of shutoff.

(5) Estimated length of time services will be interrupted.

12.3.3 It is the Contractor's responsibility to coordinate any and all utility outages with the appropriate local authorities and utility providers and once the permission is granted from said authorities and utility providers, the government is then to be notified of the dates, times and durations of any outages. Services shall not be shutoff until receipt of approval of the proposed hours and date from the Contracting Officer.

12.3.4 Shutoffs which will cause interruption of Government work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or on non-work days of the Using Agency without any additional cost to the Government.

12.3.5 Operation of valves on water mains will be by Government personnel. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay or to restore service without delay in event of emergency.

12.3.6 Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off.

13. QUANTITY SURVEYS (APR 1984) ALTERNATE I (APR 1984) FAR 52.236-16I.

13.1 Quantity surveys shall be conducted, and the data derived from these surveys shall be used in computing the quantities of work performed and the actual construction completed and in place.

13.2 The Contractor shall conduct the original and final surveys and surveys for any periods for which progress payments are requested. All these surveys shall be conducted under the direction of a representative of the Contracting Officer, unless the Contracting Officer waives this requirement in a specific instance. The Government shall make such computations as are necessary to determine the quantities of work performed or finally in place. The Contractor shall make the computations based on the surveys for any periods for which progress payments are requested.

13.3 Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

13.4 All Contractor surveys shall be conducted by a licensed Land Surveyor, unless the Contracting Officer waives this requirement in a specific instance.

14. NOT USED.

15. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) FAR 52.236-1 (Para. 15 only). The Contractor shall perform on the site, and with its own organization, work equivalent to at least 20 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

15.1 For purposes of this paragraph "WORK BY THE CONTRACTOR" is defined as prime Contractor direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, equipment, or subcontractors. The "TOTAL AMOUNT OF WORK" is defined as total direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, or equipment.

15.2 Within 7 days after the award of any subcontract, either by himself or a subcontractor, the Contractor shall deliver to the Contracting Officer a completed SF 1413, "Statement and Acknowledgment." The form shall include the subcontractor's acknowledgement of the inclusion in his subcontract of the clauses of this contract entitled "Davis-Bacon Act," "Contract Work Hours and Safety Standards Act-Overtime Compensation," "Apprentices and Trainees," "Compliance with Copeland Regulations," "Withholding of Funds," "Subcontracts," "Contract Termination-Debarment," and "Payrolls and Basic Records." Nothing contained in this contract shall create any contractual relation between the subcontractor and the Government.

16. NOT USED.

17. SUPERINTENDENCE OF SUBCONTRACTORS

17.1 The Contractor shall be required to furnish the following, in addition to the superintendence required by CONTRACT CLAUSE: SUPERINTENDENCE BY THE CONTRACTOR.

(1) If more than 50 percent and less than 70 percent of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70 percent or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing , inspecting and expediting the subcontract work.

17.2 If the Contracting Officer, at any time after 50 percent of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirements for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

18. IDENTIFICATION OF EMPLOYEES.

18.1 The Contractor shall be responsible for furnishing an identification badge/card to each employee prior to the employees work on-site, and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of the employee. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

19. NOT USED.

20. WARRANTY OF CONSTRUCTION (MAR 1984) ALTERNATE 1 (APR 1984) FAR 52.246-21I.

20.1 General Requirements.

20.1.1 In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 20.1.10 of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

20.1.1.1 Warranty Payment: Warranty work is a subsidiary portion of the contract work, and has a value to the Government approximating 1.5% of the contract award amount. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: Payments Under Fixed-Price Construction Contracts. If the Contractor fails to respond to warranty items as provided in paragraph 20.5, the Government may elect to acquire warranty repairs through other sources and, if so, shall backcharge the Contractor for the cost of such repairs. Such backcharges shall be accomplished under the Changes Clauses of the contract through a credit modification(s).

A portion of the above described sum is for the reimbursement of the government charged at a rate of $75.00 per event for each event investigated by the government and classified as a warranty item. Such backcharges shall also be accomplished under the Changes Clauses of the contract through a credit modification(s).

The balance of the Warranty Payment amount is a sum payable to the contractor as if it were a progress payment at the 3, 6, 9 and 12 month intervals within the 12 month warranty period. Specific amounts to be paid at the indicated intervals is at the discretion of the Contracting Officer's designated representative.

20.1.2 This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(a) As a part of the one year warranty inspection, the Contracting Officer will conduct an infrared roof survey on any project involving a membrane roofing system. This survey will be conducted in accordance with ASTM C1153-90, "Standard Practice for the Location of Wet Insulation in Roofing Systems Using Infrared Imaging". In accordance with paragraph 20.1.3 and 20.1.4, the Contractor shall be required to replace all damaged materials and to locate and repair sources of moisture penetration.

20.1.3 The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(a) The Contractor's failure to conform to contract requirements; or

(b) Any defect of equipment, material, workmanship, or design furnished.

20.1.4 The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

20.1.5 The Contracting Officer shall notify the Contractor, in writing, (see para. 20.2.3 and 20.5) within a reasonable time after the discovery of any failure, defect, or damage.

20.1.6 If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, (see para. 20.5) the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

20.1.7 With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(a) Obtain all warranties that would be given in normal commercial practice;

(b) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(c) Provide names, addresses, and telephone numbers of all subcontractors, equipment suppliers, or manufacturers with specific designation of their area of responsibilities if they are to be contacted directly on warranty corrections; and

(d) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

20.1.8 In the event the Contractor's warranty under paragraph 20.1.2 of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

20.1.9 Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

20.1.10 This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

20.1.11 Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

20.2 Performance Bond.

20.2.1 The Contractor's Performance Bond will remain effective throughout the construction warranty period and warranty extensions.

20.2.2 In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

20.2.3 Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 20.5. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor as outlined in the paragraph 20.2.2 above.

20.3 Pre-Warranty Conference. Prior to contract completion and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warrantied construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

20.4 Equipment Warranty Identification Tags.

20.4.1 The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

(a) The tags shall be similar in format and size to the exhibits provided by this specification, they shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

(b) Sample tags shall be submitted for Government review and approval. These tags shall be filled out representative of how the Contractor will complete all other tags.

(c) Tags for Warrantied Equipment: The tag for this equipment shall be similar to the following. Exact format and size will be as approved.

EQUIPMENT WARRANTY
CONTRACTOR FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

EQUIPMENT WARRANTY
GOVERNMENT FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration date will be determined as specified by para. 20.1.

20.4.2 Execution. The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

20.4.3 Payment. The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS.

20.4.4 Equipment Warranty Tag Replacement. As stated in para. 20.1.4, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

20.5 Contractor's Response to Warranty Service Requirements.

20.5.1 Following oral or written notification by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below.

First Priority Code 1 Perform on site inspection to evaluate situation, determine course of action, initiate work within 24 hours and work continuously to completion or relief.

Second Priority Code 2 Perform on site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion or relief.

Third Priority Code 3 All other work to be initiated within 5 work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

Code 1 Air Traffic Control and Air Navigation Systems and Equipment.

Code 1 Air Conditioning System
- a. Hospital.
- b. Buildings with computer equipment.
- c. Commissary and Main PX.
- d. Clubs.
- e. Barracks, mess halls, BOQ/BEQ (entire building down).
- f. Troop medical and dental.

Code 2 Air Conditioning Systems
- a. Recreational support.
- b. Air conditioning leak in part of building, if causing damage.
- c. Admin buildings with ADP equipment not on priority list.

Code 1 Doors
- a. Overhead doors not operational.

Code 1 Electrical
- a. Power failure (entire area or any building operational after 1600 hours).
- b. Traffic control devices.
- c. Security lights.

Code 2 Electrical
- a. Power failure (no power to a room or part of building).
- b. Receptacle and lights.
- c. Fire alarm systems.

Code 1 Gas
- a. Leaks and breaks.
- b. No gas to family housing unit or cantonment area.

Code 1 Heat
- a. Hospital/Medical facilities.
- b. Commissary and Main PX.
- c. Clubs.
- d. Area power failure affecting heat.

Code 2 Heat
- a. Medical storage.
- b. Barracks.

Code 1 Intrusion Detection Systems
Finance, PX and Commissary, and high security areas.

Code 2 Intrusion Detection Systems
Systems other than those listed under Code 1.

Code 1 Kitchen Equipment
- a. Dishwasher.
- b. All other equipment hampering preparation of a meal.

Code 2 Kitchen Equipment
All other equipment not listed under Code 1.

Code 2 Plumbing
a. Flush valves.
b. Fixture drain, supply line commode, or water pipe leaking.
c. Commode leaking at base.

Code 1 Refrigeration
a. Commissary.
b. Mess Hall.
c. Cold Storage.
d. Hospital.
e. Medical storage.

Code 2 Refrigeration
Mess hall - other than walk-in refrigerators and freezers.

Code 1 Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2 Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 1 Swimming Pools
Chlorine leaks or broken pumps.

Code 1 Tank Wash Racks (Bird Baths)
All systems which prevent tank wash.

Code 1 Water (Exterior)
Normal operation of water pump station.

Code 2 Water (Exterior)
No water to facility.

Code 1 Water, Hot (and Steam)
a. Hospitals.
b. Mess halls.
c. BOQ, BEQ, barracks (entire building).
d. Medical and dental.

Code 2 Water, Hot
No hot water in portion of building listed under Code 1 (items a through c).

Code 1 Sprinkler System
All sprinkler systems, valves, manholes, deluge systems, and air systems to sprinklers.

20.5.2 Should parts be required to complete the work and the parts are not immediately available the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to

perform permanent warranty repair. The Contractors proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

21. thru 27. NOT USED.

28. IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY (APR 1984) FAR 52.245-3.

28.1 The Government will furnish to the Contractor the property identified in the Schedule to be incorporated or installed into the work or used in performing the contract. The listed property will be furnished at the place specified below. When the property is delivered, the Contractor shall verify its quantity and condition and acknowledge receipt in writing to the Contracting Officer. The Contractor shall also report in writing to the Contracting Officer within 24 hours of delivery any damage to or shortage of the property as received. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated in this contract.

28.2 The Contractor is required to transport the property to the jobsite at its own expense.

28.3 Each item of property to be furnished under this clause shall be identified in the Schedule by quantity, item, and description.

Quantity	Item	Description
	Door Hardware	

29. and 30. NOT USED.

(1) 31. PROJECT SIGN.

31.1 General. The Contractor shall furnish and erect at the location directed one project sign. The sign shall be lettered on one side only and shall conform to the details shown on the sketch bound with the SPECIAL CONTRACT REQUIREMENTS.

31.1.1 Project nomenclature shall be:

Renovate Headquarters
Devens, MA

31.1.2 Architect-Engineer name shall be:

Mason and Hanger Group, Inc.
Lexington, KY

31.2 Materials. The sign shall be constructed of good sound materials suitable for the purpose. Lumber shall be salt treated softwood of No. 2 grade or better. Sizes shown are nominal. Plywood shall be 1/2-inch, B-B, marine grade. Screws shall be of commercial quality and of sizes shown.

31.3 Painting. The sign and posts shall be given one prime coat and two finish coats of gloss exterior-type enamel paint, Glidden, Reddish Brown, Part No. 4537-5PER. All lettering shall be white.

31.4 Logos (Air Force and Corps Castle) will be furnished to the Contractor by Contracting Officer and shall be applied at the location shown.

31.5 Erection and Maintenance. The sign shall be erected at the designated location. Sign shall be plumb and backfill of post holes shall be well tamped to properly support the sign in position throughout the life of the contract. The sign shall be maintained in good condition until completion of the contract, shall remain the property of the Contractor, and shall be removed from the site upon completion of work under the contract.

31.6 Payment. No separate payment will be made for furnishing and erecting the project sign as specified and costs thereof shall be considered a subsidiary obligation of the Contractor.

32. NOT USED.

33. WAGE RATES. The decision of the Secretary of Labor, covering rates of wages, including fringe benefits to be paid laborers and mechanics performing work under this contract, is attached hereto. The payment for all classes of laborers and mechanics actually employed to perform work under the contract will be specified in the following contract clauses: DAVIS-BACON ACT, CONTRACT WORK HOURS AND SAFETY STANDARDS ACT, and THE COPELAND ACT.

34. NOT USED.

35. INTERFERENCE WITH TRAFFIC AND PUBLIC AND PRIVATE PROPERTY.

35.1 The Contractor at all times shall dispose his plant and conduct the work in such manner as to cause as little interference as possible with private and public travel. Damage (other than that resulting from normal wear and tear) to roads, shall be repaired to as good a condition as they were prior to the beginning of work and to the satisfaction of the Contracting Officer.

35.2 The Contractor shall provide and maintain as may be required by the State of Massachusetts, Department of Transportation, proper barricades, fences, danger signals and lights, provide a sufficient number of watchmen, and take such other precautions as may be necessary to protect life, property and structures, and shall be liable for and hold the Government free and harmless from all damages occasioned in any way by his act or neglect, or that of his agents, employees, or workmen.

36. NOT USED.

37. GOVERNMENT FIELD OFFICE FACILITIES

37.1 The Contractor, at no additional cost to the Government is to provide the following:

a. Construction trailer, lockable, minimum size of 12 feet by 25 feet with heat and air conditioning.

b. Electrical Service

c. Local telephone service (one line, unlimited service)

d. Office furniture to include tow desks (minimum of size of 3’ x 6’) with arm chairs on caters and one table (minimum size of 3’ x 6’).

e. Small plan rack

f. Two lockable, four drawer filing cabinets

g. Plan table.

37.2. At completion of the project, the Contractor will, at no additional cost to the Government, remove the trailer from the job site and restore the area as necessary.

38. COMPLIANCE WITH POST/BASE REGULATIONS. The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, sanitary requirements, pollution control and traffic regulations, shall be observed by the Contractor. Information regarding these requirements may be obtained by contacting the Contracting Officer, who will provide such information or assist in obtaining same from appropriate authorities.

38.1 Contractor personnel shall park only in areas authorized by the Contracting Officer.
20 March 1997

39. EQUIPMENT AND OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995) EFAR 52.231-5000.

39.1 This does not apply to terminations. See 52.249,5000, Basis for Settlement of Proposals and FAR Part 49.

39.2 Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region II. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time of negotiations shall apply.

39.3 Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

39.4 When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the Contracting Officer shall request the Contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Cover Sheet.

39.5 Whenever a modification or equitable adjustment of contract price is required, the contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of SPECIAL CONTRACT REQUIREMENT: EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. A copy of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule" is available for review at the office of the District Engineer, Room 821, 600 Dr. Martin Luther King, Jr. Place, Louisville, Kentucky, or a copy may be ordered from the Government Printing Office at a cost of $11.00 by calling telephone no. (301) 953-7974.

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9	008-022-00262-6
10	008-022-00263-4
11	008-022-00264-2
12	008-022-00265-1

40. thru 42. NOT USED.

43. PAYMENT FOR MATERIALS DELIVERED OFFSITE. (MAR 1995) EFARS 52.232-5000.

43.1 Pursuant to CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS at the discretion of the Contracting Officer, materials delivered to the Contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the CONTRACT CLAUSES are fulfilled. Payment for items delivered to locations other than the worksite will be limited to:

(1) Materials required by the technical provisions,

(2) Materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

43.2 Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contract and including the value of material and labor incorporated into the item.

44. NOT USED.

45. INSURANCE--WORK ON A GOVERNMENT INSTALLATION (SEP 1989) FAR 52.228-5.

45.1 The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(1) Coverage complying with State laws governing insurance requirements, such as those requirements pertaining to Workman's Compensation and Occupational Disease Insurance. Employer's Liability Insurance shall be furnished in limits of not less than $100,000.00 except in states with exclusive or monopolistic funds.

(2) Comprehensive General Liability Insurance for bodily injury coverage shall be furnished in limits of not less than $500,000 per occurrence.

(3) Comprehensive Automobile Liability Insurance for both bodily injury and property damage, shall be furnished in limits of not less than $200,000.00 per person, $500,000.00 per accident for bodily injury, and $20,000.00 per accident for property damage. When the Financial Responsibility or Compulsory Insurance Law of the State, requires higher limits, the policy shall provide for coverage of at least those higher limits.

45.2 Before commencing work under this contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

45.3 The Contractor shall insert the substance of this clause, including this paragraph (45.3), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

46. IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM

46.1 The Contractor shall utilize a Government furnished software program titled, "RMS" (Resident Management System) to maintain critical information needed to manage the project. RMS produces up-to-date management and analysis reports as well as a majority of the forms required in this contract for submission to the Government. Some of these forms are shown as samples at the end of this section. They include ENG 4288 (Submittal Register), ENG 4025 (Transmittal form), CQC Daily Report, Transfer Property Information Form, Definable Feature of Work Form, User Schooling Information Form, Quality Control Testing Information, and Installed Property Information Form.

46.2 The following hardware and software are needed by the Contractor to run RMS: a personal computer with 80386 process (or higher) and four megabytes (MB) or more of random access memory (RAM) and a 3 1/2 inch high density floppy drive. Also needed is a HP Laser Jet Series II, III, IV or V printer, a color monitor, MS-DOS, version 5.0 or later, Word Perfect, version 5.1 or later, and Computer files = 81.

46.3 Once the Contract is awarded, the Contractor will be given a cop of the RMS program for implementation. A meeting between the Government and the Contractor will be arranged to inform the Contractor on the use of the software package which is similar to the one the Government will use to manage the project. File updates will be transferred to the Government by disk on a weekly basis, unless electronic transfers are agreed on.

47. NOT USED.

48. DEFINITIONS. The following provision is applicable to the SPECIFICATIONS, of this solicitation: The term GENERAL PROVISIONS shall mean CONTRACT CLAUSES, the terms SPECIAL PROVISIONS and SPECIAL CLAUSES shall mean SPECIAL CONTRACT REQUIREMENTS.

49. NOT USED

50. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. ER 415-1-15 (31 OCT 89)

50.1 This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the contract clause entitled "Default: Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

50.1.1 The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

50.1.2 The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

50.2 The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(10)	(8)	(8)	(7)	(7)	(7)	(7)	(7)	(7)	(6)	(9)	(11)

50.3 Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 50.2, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)".

51. and 52. NOT USED.

53. AVAILABILITY OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1). As covered by CONTRACT CLAUSE "ACCIDENT PREVENTION", compliance with EM 385-1-1 is a requirement for this contract. Copies may be purchased for $31.00 each at the following address:

United States Government Bookstore
Room 118, Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222
Telephone: (412) 644-2721
FAX: (412) 644-4547

Or downloaded from the following website:

http://www.hnd.usace.army.mil
TECHINFO
Engineering Manuals

54. FIRE PROTECTION DURING CONSTRUCTION (MIL-HDBK-1008c Para. 1.6) The Contractor is alerted to the requirements of Contract Clause "CLEANING UP" and more specifically to the requirements for fire protection during construction spelled out in EM 385-1-1 and NFPA No. 241 Building Construction and Demolition Operations. This item must be covered in the submittal required under Contract Clause "ACCIDENT PREVENTION".

55. thru 57. NOT USED.

58. CONSTRUCTION HAZARD COMMUNICATION. The Contractor is required to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1926.59). This standard is designed to inform workers of safe and appropriate methods of working with hazardous substances in the workplace. The standard has five requirements, and every hazardous or potentially hazardous substance used or stored in the work area is subject to all five. They are:

(1) Hazard Evaluation. Any company which produces or imports a chemical or compound must conduct a hazard evaluation of the substance to determine its potential health or physical hazard. The hazard evaluation consists of an investigation of all the available scientific evidence about the substance. The Contractor is required to assure that all producers (manufacturer/distributors) have performed these evaluations and transmit the required information with any hazardous materials being used or stored on the project site. From the hazard evaluation, a substance may be classified as a health hazard, or a physical hazard. These classifications are then further broken down according to type:

Health Hazards	Physical Hazards
Carcinogens	Combustible liquids
Irritants	Compressed gases
Sensitizers	Explosives
Corrosives	Flammables
Toxic substances	Organic peroxides
Highly toxic substances	Unstable substances
Substances harmful to specific organs or parts of the body	Water-reactive substances

(2) Warning Labels. If a chemical is hazardous or potentially hazardous, the producer or importer must affix a warning label to every container of that chemical before it leaves his facility. The Contractor must assure these labels are attached and legible. The label must identify the chemical, state the hazard, and give the name and address of the producer or importer. If the hazardous substance is transferred to another container, that container must then be labeled, tagged, or marked with the name of the chemical and the appropriate hazard warning. Warning labels should be replaced immediately if they are defaced or removed.

(3) Material Safety Data Sheets. The producer or importer must also supply a material safety data sheet (MSDS). The Contractor must keep these available in the work area where the substance is used, so that the people using the substance can easily review important safety and health information, such as:

The hazard possible from misuse of the substance
Precautions necessary for use, handling, and storage
Emergency procedures for leaks, spills, fire and first aid
Useful facts about the substance's physical or chemical properties

(4) Work Area Specific Training. Because of hazardous substance may react differently depending on how it is used or the environment of the work area, the Contractor must conduct work area specific training; special training which takes the Contractor's operations, environment, and work policies into consideration. Work area training presents:

The hazardous substances which are present in the work place and the hazards they pose

Ways to protect against those hazards, such as protective equipment, emergency procedures, and safe handling

Where the MSDS's are kept, and an explanation of the labeling system
Where the Contractor's written Hazard Communication Program is located

(5) The Written Hazard Communication Program. In accordance with OSHA requirements, the Contractor must prepare a written Hazard Communication Program. This document will be included in the Contractor's Accident Prevention Plan. This document states how the Contractor plans to ensure that hazardous materials are appropriately labeled, how and where MSDS's will be maintained, and how employees will be provided with specific information and training.

59. and 60. NOT USED.

61. MECHANICAL ROOM LAYOUT (ORL). Detailed mechanical room layout drawings shall be submitted for approval in accordance with SD-04 Section 01330. Layout drawings shall show location and maintenance clearances for all mechanical room equipment, and all utility runs/chases for mechanical, electrical, telephone and other similar systems. Drawings shall be submitted at the same time as the submittals for the equipment to be located within the mechanical room.

62. thru 67. NOT USED.

68. FIRMR APPLICABILITY (Oct 89 FIRMR) This solicitation/contract requires the use or delivery of Federal information processing resources but the agency has determined that FIRMR part 201-39 does not apply based on the exception set forth in 201-39.101-3(b)(5)(ii).

69. and 70. NOT USED.

71. PARTNERING. In order to most effectively accomplish this contract, the Government proposes to form a partnership with the Contractor to develop a cohesive building team. It is anticipated that this partnership would involve the Corps of Engineers, the Contractor, primary subcontractors and the designers. This partnership would strive to develop a cooperative management team drawing on the strengths of each team member in an effort to achieve a quality project within budget and on schedule. This partnership would be bilateral in membership and participation will be totally voluntary. Any cost associated with effectuating this partnership, excluding travel and lodging cost of Government personnel, will be borne by the Contractor.

72. thru 84. NOT USED.

85. YEAR 2000 COMPLIANCE

a. In accordance with FAR 39.106, the Contractor shall ensure that with respect to any design, construction, goods, or services under this contract as well as any subsequent task/delivery orders issued under this contract (if applicable), all information technology contained therein shall be Year 2000 compliant. Specifically:

b. The Contractor shall:

(1) Perform, maintain, and provide an inventory of all major components to include structures, equipment, items, parts, and furnishings under this contract and each task/delivery order which may be affected by the Y2K compliance requirements.

(2) Indicate whether each component is currently Year 2000 compliant or requires an upgrade for compliance prior to government acceptance.

86. SECTION 8(a) Direct Award (JUNE 1998) DFARS 252.219-7009

(a) This contract is issued as a direct award between the contracting office and the 8(a) Contractor pursuant to the Memorandum of Understanding dated May 6, 1998, between the Small Business Administration (SBA) and the Department of Defense. Accordingly, the SBA is not a partly to this contract. SBA does retain responsibility for 8(a) certification, for 8(a) eligibility determinations and related issues, and for providing counseling and assistance to the 8(a) Contractor under the 8(a) Program. The cognizant SBA district office is:

SBA
10 Causeway St.
Boston, MA 02222-1093
617-565-8415

(b) The contracting office is responsible for administering the contract and for taking any action o behalf of the Government under the terms and conditions of the contract; provided that the contracting office shall give advance notice to the SBA before it issues a final notice terminating performance, either in whole or in part, under the contract. The contacting office also shall coordinate with the SBA prior to processing any novation agreement. The contracting office may assign contract administration functions to a contract administration office.

(c) The Contractor agrees that—

(1) It will notify the Contracting Officer, simultaneous with its notification to the SBA (as required by SBA's 8(a) regulations at 13 CFR 124.308), when the owner or owners upon whom 8(a) eligibility is based plan to relinquish ownership or control of the concern. Consistent with Section 407 of Pub. L. 100-656, transfer of ownership or control shall result in termination of the contract for convenience, unless the SBA waives the requirements for termination prior to the actual relinquishing of ownership and control; and

(2) It will not subcontract the performance of any of the requirements of this contract without the prior written approval of the SBA and the Contracting Officer.

STATEMENT AND ACKNOWLEDGMENT

FORM APPROVED OMB NO
9000-0014

Public reporting burden for this collection of information is estimated to average .15 hours per response, including the time for reviewing instructions. Searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the suggestions for reducing this burden, to the FAR Secretarial (VRS), Office of Federal Acquisition and Regulatory Policy, GSA Washington, D.C. 20405: and to the Office of Management and Budget, Paperwork Reduction Project (9000-0014), Washington, D.C. 20503

PART I - STATEMENT OF PRIME CONTRACTOR

1. PRIME CONTRACT NO.	2. DATE SUBCONTRACT AWARDED	3. SUBCONTRACT NUMBER
4. PRIME CONTRACTOR (Name, address and ZIP code)		5. SUBCONTRACTOR (Name, address and ZIP code)

6. The prime contractor states that under the contract shown in item 1, a subcontract was awarded on date shown in item 2 by (Name of Awarding Firm)

to the subcontractor identified in item 5, for the following work:

7. PROJECT	8. LOCATION	
9. NAME AND TITLE OF PERSON SIGNING	10. BY (Signature)	11. DATE SIGNED

PART II - ACKNOWLEDGMENT OF SUBCONTRACTOR

12. The subcontractor acknowledges that the following clauses of the contract shown in item 1 are included in this subcontract:

Contract Work Hours and Safety Standards Act - Overtime Compensation - Construction	David-Bacon Act
Payrolls and Basic Records	Apprentices and Trainees
Withholding of Funds	Compliance with Copeland Regulations
Disputes Concerning Labor Standards	Subcontracts
	Contract Termination-Debarment
	Certification of Eligibility

13. NAME(S) OF ANY INTERMEDIATE SUBCONTRACTORS, IF ANY

14. NAME AND TITTLE OF PERSON SIGNING	15. BY (Signature)	16 DATE SIGNED

24 October 1988

(Sample of Typical contractor Quality report)

CONTRACTOR'S NAME
(Address)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Contract No:_____ Date:_____ Report No._____
Project Name_____
Weather: (Clear) (P. Cloudy) (Cloudy); Temperature: ____Min. ____Max; ____Rainfall ____in.

Contractor/Subcontractors/Supplier	Area of Responsibility
a.	
b.	
c.	
d.	
e.	
f.	
g.	

1. Definable Features of Construction in Progress: (Give briefly only definable features of work in progress and location. Refer to work performed by prime and/or subcontractor and/or supplier by letter in table above).

2. Material and/or Equipment Delivered to site:

3. Results of Surveillance:

Preparatory Phase (Attach minutes):

Initial Phase (Attach minutes):

Follow-up Phase (Include satisfactory work completed and/or deficiencies with action to be taken):

4. Tests Required by Plans and/or Specification Performed and results of Test: (Attach results of test taken on previous dates).

5. Verbal Instructions Received: (List any instructions given by Government Personnel on construction deficiencies. Retesting required, etc., with action to be taken.

6. Safety Deficiencies Noted. (Describe corrective actions taken).

7. Remarks: (Cover any conflicts in plans, specifications, or instruction).

CONTRACTOR'S VERIFICATION: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

Contractor's Authorized QC Representative

All Construction Project Identification signs and Safety Performance signs are to be fabricated and installed as described below. The signs are to be erected at a location designated by the contracting officer and shall conform to the size, format, and typographic standards shown

The sign panels are to be fabricated from .75" High Density Overlay Plywood.

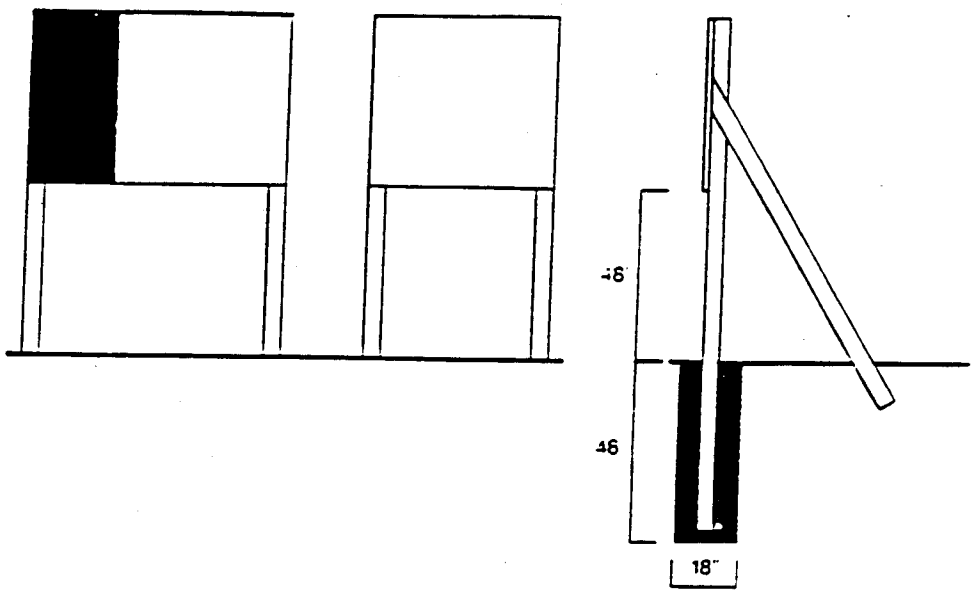
All graphics are to be applied to the background panel following the graphic formats as indicated.

Drill and insert six (6) .375" T-nuts from the front face of the HDO sign panel. Flange of T-nut to be flush with sign face.

Apply lettering and logo to prepared HDO plywood panel.

Sign uprights to be structural grade 4"x4" treated Douglas Fir or Southern Yellow Pine, No. 1 or better. Post to be 12' long. Drill six (6) .375" mounting holes in uprights to align with T-nuts in sign panel. Countersink (.5") back of hole to accept socket head cap screw (4"x.375").

Assemble sign panel and uprights. Imbed assembled sign panel and uprights in 4' hole. Bolt additional 2"x4" struts on inside face of uprights to reinforce installation as shown.



Construction Project Sign

Legend Group 1: Corps Relationship

1. _____
2. _____

Legend Group 2: Corps Signature

1. U.S. Army Corps
2. of Engineers

Legend Group 2A: District Name

1. _____
2. _____

Legend Group 3: Project Title

1. _____
2. _____
3. _____

Legend Group 4: Facility Name

1. _____
2. _____

Legend Group 5a: Designer

1. _____
2. _____
3. _____
4. _____
5. _____

Legend Group 5b: Contractor

1. _____
2. _____
3. _____
4. _____
5. _____

Introduction: Project Identification Sign

Below are two samples of the construction project identification sign showing how this panel is adaptable for use to identify either civil works projects with a local sponsor (top) or military (bottom). The graphic format for this 4' x 6' sign panel follows the legend guidelines and layout as specified below. The large 4' x 4' section of the panel on the right is to be white with black legend. For the top sign, the upper left 2' x 2' section of the sign with the full Corps signature is to be painted Communications Red with white lettering. The lower left 2' x 2' section of the sign shall match the local sponsor's colors with white lettering. For the bottom sign, the 2' x 4' left section of the sign with full Corps signature is to be painted Communications Red with white lettering. Mounting and fabrication details are provided.

Legend Group 1: One-to two-line description of Corps relationship to project.
Color: White
Typeface: 1.25" Helvetica Regular
Maximum line length: 19"

Legend Group 2: Two-line Corps Signature (US Army Corps of Engineers). Placed below Corps Castle
Color: White
Typeface: 1.5" Helvetica Bold

Legend Group 2a: District Name. Placed below Signature (6" Castle).
Color: White
Typeface: 1.25" Helvetica Regular

Legend Group 3: Words "Local Sponsor"
Color: White
Typeface: 1.25" Helvetica Regular
Maximum length: 19"

Legend Group 4: One-to-three lines for name of local sponsor
Color: White
Typeface: 1.5" Helvetica Regular

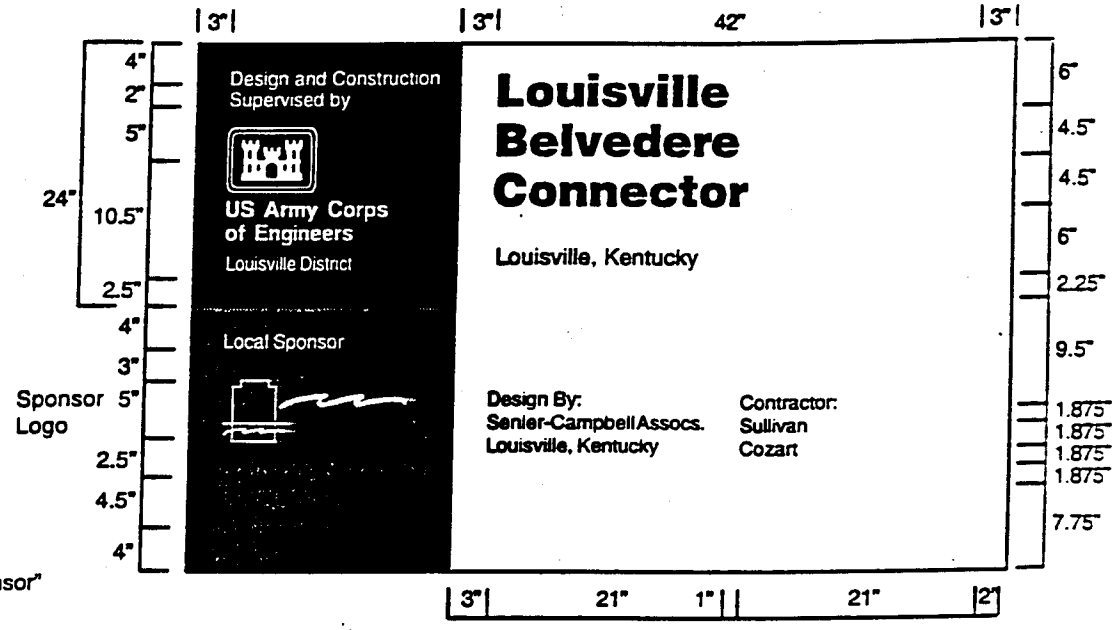
Legend Group 5: One- to three-line project title legend describes the work being done under this contract.
Color: Black
Typeface: 3" Helvetica Bold
Maximum line length: 42"

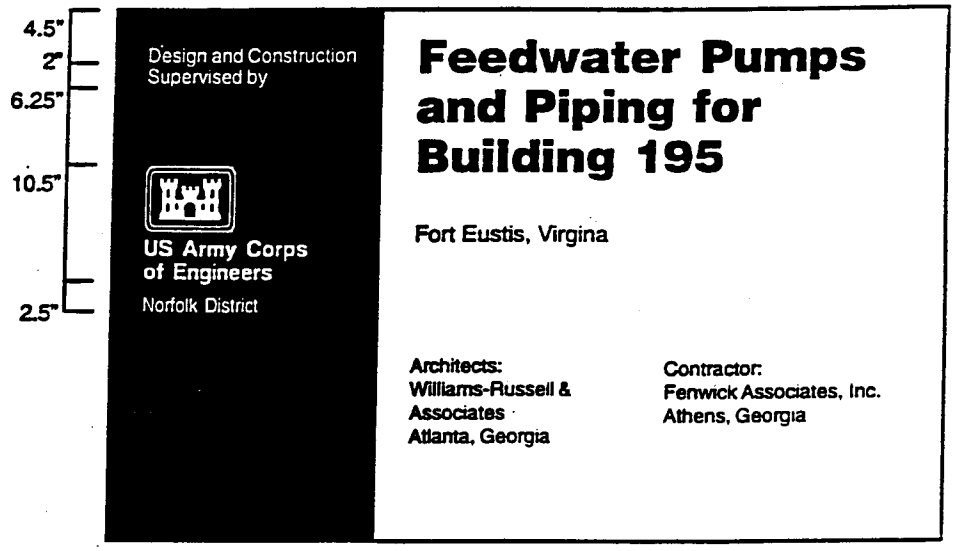
Legend Group 6: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Cross-align the first line of Legend Group 5 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 7a-b: One- to five-line identification of prime contractors including: type (general contractor, etc.) corporate or firm name, city, state.
Color: Black
Typeface: 1.25" Helvetica Regular
Maximum line length: 21"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown.





Legend Size	Panel Size	Post Size	Mounting Height	Color Bkg/Lgd
Various	4' x 6'	4" x 4"	48"	WH-RD/BK

SUBMITTAL REGISTER

(ER 415-1-10)

CONTRACT NO.:

TITLE AND LOCATION

CONTRACTOR:

SPECIFICATION SECTION:

ACTIVITY NO	TRANS-MITTAL NO.	ITEM NO	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
					DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	O&M MANUALS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE *(Read instructions on the reverse side prior to initiating this form)*	DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. *(Cover only one section with each transmittal)*	PROJECT TITLE AND LOCATION		CHECK ONE: THIS TRANSMITTAL IS FOR FIO ☐ GOV'T ☐ APPROVAL

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See Instruction no. 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE g.	VARIATION (See instruction no. 6) h.	FOR CE USE CODE i.
				SPEC. PARA. NO. e.	DRAWING SHEET NO. f.			

REMARKS	I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated _____ NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

Instructions

1. Section I will be initiated by the contractor in the required number of copies.

2. Each transmittal shall be numbered consecutively in the space provided for “Transmittal No.”. This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; in resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The “Item No.” will be the same “Item No.” as indicated on ENG FORM 4288-R for each entry on this form.

5. Separate transmittal form will be used for submittals under separate section of the specifications.

6. a check shall be placed in the “Variation” column when a submittal is not in accordance with the plans and specifications—also, a written statement to that effect shall be included in the space provided for “Remarks.

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer’s Certificate of Compliance is transmitted, indicate “Sample” or “Certificate” in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g. to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A – Approved as submitted.

B – Approved, except as noted on drawings.

C – Approved, except as noted on drawings. Refer to attached sheet resubmission required.

D – Will be returned by separate correspondence.

E – Disapproved (See attached).

F – Receipt acknowledged.

FX – Receipt acknowledged, does not comply as noted with contract requirements.

G – Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG form 4025-R)

EQUIPMENT-IN-PLACE LIST

Contract No._____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

(If Para. 10 is used, use this form)

DEFICIENCY LIST

CONTRACT NUMBER:_____ PROJECT: _____

		DEFICIENCY		CORRECTION		
DEFIC. NO.	DESCRIPTION	DATE OBSERVED	CQC REPORT NO.	DATE CORRECTED	CQC REPORT NO.	COMMENTS

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPECIFICATION SECTIO

TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL									CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
				DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		01570	TEMPORARY CONTROLS																					
		1.4	HAZARD WASTE CERT.									X		X										
		1.4	CONFINED SPACE ENTRY					X						X										
		1.4	ENVRNMNT QUALITY PERMIT					X						X										
		1.4	ENVRNMNTL PROTECT PLAN					X						X										
		1.4	ENVRNMNTL TRAIN DOCUME									X	X											
		1.4	EROSION, SEDIMENT CNTRL									X	X											
		1.4	HAZARD. WASTE DISPOSAL									X		X										
		1.4	HEALTH & SAFETY PLAN					X						X										
		1.4	LAB ANALYSIS SANDBLASTIN						X					X										
		1.4	MSDS CLASS I ODS					X					X											
		1.4	NOTICE OF INTENT					X						X										
		1.4	NOTICE OF TERMINATION					X						X										
		1.4	PERMIT STORM WTR DISCHA					X						X										
		1.4	POLLUTION PREVENTION					X						X										
		1.4	PRECONSTRUCT SURVEY RP					X					X											
		1.4	SOLID WASTE DISPOSAL									X		X										
		1.4	SPECIAL SAFTEY PLAN					X					X											
		1.4	TRANSPORT HAZARD WST PE									X		X										
		02050	DEMOLITION																					
		1.3	WORK PLAN									X		X										
		02221	EXCAVATION FOR BUILDINGS																					
		1.3A	TEST REPORTS						X					X										
		02232	SUBBASE COURSE																					
		1.3A	LIST OF EQUIPMENT	X									X											
		1.3B	SAMPLING AND TESTING						X					X										
		1.3C	TEST FACILITY									X	X											
		02233	BASE COURSE																					
		1.2A	SAMPLING AND TESTING						X					X										
		02443	LOW PERM. CLAY LAYER																					
		1.3A	MATERAILS HANDLING PLAN	X										X										
		1.3B	COMMERCIAL TEST LAB					X					X											
		1.3C	BORROW SOURCE ASSESS.						X					X										
		1.3C	BORROW TESTS						X					X										
		1.3C	SUBGRADE TESTING						X					X										

SUBMITTAL REGISTER (ER415-1-10)																						CONTRACT NO.
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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		03150	EXPANSION & CONSTRUCTIO																					
		1.2A	EXPANSION JOINT FILLER	X									X											
		1.2B	INSTRUCTIONS	X									X											
		1.2C	CERTIFICATES	X									X											
		1.2D	SEALANT	X									X											
		1.2E	INSTRUCTIONS	X									X											
		1.2F	CERTIFICATES	X									X											
		1.2G	WATERSTOPS	X									X											
		1.2H	INSTRUCTIONS	X									X											
		1.2I	CERTIFICATES	X									X											
		03300	CAST-IN-PLACE CONCRETE																					
		1.9	REBAR PLACING DRWGS		X									X										
		1.11A.3.e	CONCRETE TEST RESULTS						X				X											
		2.2A.3	CONCRETE MILL TEST REPOI						X				X											
		2.2B.8	CERTIFICATION ADMIXTURES							X			X											
		2.3B.1	GROUT/MORTAR TEST RESUI						X				X											
		2.9A.5.b	MIX DESIGN						X					X										
		03530	SELF-LEVELING CONCRETE F																					
		1.2A	PRODUCT DATA											X										
		1.2B	CERTIFICATES											X										
		04100	MORTAR AND MASONRY GRO																					
		1.2A	DESIGN MIX	X									X											
		1.2B	SAMPLES								X			X										
		1.2C	MORTAR REPORTS						X				X											
		1.2D	GROUT REPORTS						X				X											
		1.2E	MANF. CERTIFICATE							X				X										
		04311	CONCRETE MASONRY UNITS																					
		1.5A	MANF. CERTIFICATE							X			X											
		1.7A	MANF. QUALIFICATIONS									X		X										
		04320	VENEER MASONRY																					
		1.5A	BRICK PRODUCT DATA	X										X										
		1.5B	BRICK SAMPLES								X			X										
		1.5C	BRICK MANF. CERTIFICATE							X			X											
		1.7A	MANF. QUALIFICATIONS									X		X										

SUBMITTAL REGISTER (ER415-1-10)																						CONTRACT NO.
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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		04340	REINFORCED UNIT MASONRY																					
		1.6A	SHOP DRAWINGS		X									X										
		1.6B	PRODUCT DATA	X										X										
		1.6C	MANF. CERTIFICATE							X			X											
		1.8A	MANF. QUALIFICATIONS									X	X											
		05120	STRUCTURAL STEEL																					
		1.6A	DRAWINGS		X									D1										
		1.6B	WELDING PROCEDURE	X										D1										
		1.6C	MILL TEST REPORTS						X				X											
		1.6D	MILL CERTIFICATES							X			X											
		1.6E	WELDERS CERTIFICATES							X			X											
		1.6F	SURVEYS								X		X											
		1.6G	MATERIAL REPORTS						X				X											
		1.6H	MANUFACTURER'S LIT.	X									X											
		1.6I	INSPECTION REPORTS						X				X											
		1.6J	QUALITY ASSURANCE CERT.							X			X											
		1.8	ERECTOR QUALIFICATIONS									X	X											
		1.8	FABRICATOR QUALIFICATION									X	X											
		05300	STEEL ROOF DECK																					
		1.7A	SHOP DRAWINGS		X									X										
		1.7B	PRODUCT DATA	X									X											
		1.7C	INSTALLATION INSTRUCT.		X								X											
		05500	METAL FABRICATIONS																					
		1.4A	SHOP DRAWINGS		X									X										
		1.5B	WELDER'S CERTIFICATES							X			X											
		05510	METAL STAIRS																					
		1.5A	SHOP DRAWINGS		X									X										
		1.6B	WELDER'S CERTIFICATES							X			X											
		06200	FINISH CARPENTRY																					
		1.5A	SHOP DRAWINGS		X									X										
		1.5B	HARDWARE INSTRUCTIONS			X							X											
		1.7A	MANF. QUALIFICATIONS									X	X											
		07191	VAPOR RETARDERS																					
		1.7B	PRODUCT DATA	X										X										
		1.7C	MANF. INSTRUCTIONS			X							X											

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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		07212	BOARD INSULATION																					
		1.5A	PRODUCT DATA	X										X										
		1.5B	MANF. INSTRUCTIONS			X							X											
		1.5C	MANF. CERTIFICATE							X			X											
		1.5D	SAMPLE								X		X											
		07213	BATT INSULATION																					
		1.5A	PRODUCT DATA	X										X										
		1.5B	MANF. CERTIFICATE							X			X											
		07270	FIRE STOPPING																					
		1.2A	DRAWINGS		X									X										
		1.2B	CERTIFICATES							X				X										
		07531	ELASTOMERIC SHEET ROOFI																					
		1.5A	SHOP DRAWINGS											X										
		1.5B	PRODUCT DATA											X										
		1.5C	SAMPLES											X										
		1.5D	MANFUCTURER'S INSTALLAT											X										
		1.5E	MANUFACTURER'S CERTIFIC/											X										
		1.5F	REPORTS											X										
		07620	SHEET METAL																					
		1.5A	SHOP DRAWINGS		X									X										
		1.5B	SAMPLES								X			X										
		1.7A	QUALIFICATIONS									X		X										
		07900	JOINT SEALERS																					
		1.4A	PRODUCT DATA	X										X										
		1.4B	SAMPLES								X		X											
		1.4C	MANF. INSTRUCTIONS			X							X											
		1.6A	MANF. QUALIFICATIONS									X		X										
		1.6B	INSTALLER QUALIFICATIONS									X		X										
		1.8	WARRANTY							X				X										
		08111	STANDARD STEEL DOORS																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X										X										
		1.4C	MANF. INSTRUCTIONS			X							X											
		1.4D	MANF. CERTIFICATE							X			X											

SUBMITTAL REGISTER
(ER415-1-10)

CONTRACT NO.

TITLE AND LOCATION

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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.6A	MANF. QUALIFICATIONS									X		X										
		08112	STANDARD STEEL FRAMES																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X										X										
		1.4C	SAMPLES								X		X											
		1.4D	MANF. INSTRUCTIONS			X							X											
		1.4E	MANF. CERTIFICATE							X			X											
		1.6A	MANF. QUALIFICATIONS									X		X										
		08211	FLUSH WOOD DOORS																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X										X										
		1.4C	SAMPLES								X		X											
		1.4D	MANF. INSTRUCTIONS			X							X											
		1.6A	MANF. QUALIFICATIONS									X		X										
		1.10	WARRANTY							X				X										
		08410	ALUM. ENT. & STOREFRONTS																					
		1.8A	SHOP DRAWINGS		X									X										
		1.8B	PRODUCT DATA	X										X										
		1.8C	SAMPLES								X			X										
		1.8D	MANF. CERTIFICATE							X			X											
		1.10A	QUALIFICATIONS									X		X										
		1.15	WARRANTY							X			X											
		08520	ALUM. WINDOWS																					
		1.6A	SHOP DRAWINGS		X									X										
		1.6B	PRODUCT DATA	X										X										
		1.6C	MANF. CERTIFICATE							X			X											
		1.6D	LAB TESTS									X	X											
		1.8	QUALIFICATIONS									X		X										
		08710	DOOR HARDWARE																					
		1.5A	SHOP DRAWINGS		X									X										
		1.5B	MANF. DATA	X										X										
		1.5C	SAMPLES								X			X										
		1.7A	MAINTENANCE DATA	X									X											
		1.9A	MANF. QUALIFICATIONS									X		X										
		1.9B	HARDWARE SUPPLIER QUALI									X		X										

SUBMITTAL REGISTER (ER415-1-10)																						CONTRACT NO.
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		1.13	WARRANTY							X			X											
		08800	GLAZING																					
		1.5A	GLASS TYPES PRODUCT DAT	X										X										
		1.5B	GLAZING COMPOUND DATA	X										X										
		1.5C	SAMPLES								X			X										
		1.6B	CERTIFICATES							X			X											
		1.6C	MANF. CERTIFICATE							X			X											
		1.7B	INSTALLER QUALIFICATIONS									X	X											
		1.9A	SEALED GLASS WARRANTY							X			X											
		1.9B	LAMINATED GLASS WARRAN							X			X											
		09111	METAL STUD FRAMING SYST																					
		1.5A	SHOP DRAWINGS		X									X										
		1.5B	PRODUCT DATA	X										X										
		1.5C	INSTALLATION INSTRUCTION			X							X											
		1.7A	INSTALLER QUALIFICATIONS									X	X											
		09260	GYPSUM BD. SYSTEMS																					
		1.5A	SHOP DRAWINGS		X									X										
		1.5B	PRODUCT DATA	X										X										
		1.7A	APPLICATOR QUALIFICATION									X	X											
		09306	FLOOR TILE																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X										X										
		1.4C	SAMPLES								X			X										
		1.4D	MANF. CERTIFICATE							X			X											
		1.5A	MAINTENANCE DATA	X									X											
		1.7A	MANF. QUALIFICATIONS									X	X											
		1.7B	INSTALLER QUALIFICATIONS									X	X											
		09307	WALL TILE																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X										X										
		1.4C	SAMPLES								X			X										
		1.4D	MANF. CERTIFICATE							X			X											
		1.5A	MAINTENANCE DATA	X									X											
		1.7A	MANF. QUALIFICATIONS									X	X											
		1.7B	INSTALLER QUALIFICATIONS									X	X											

SUBMITTAL REGISTER (ER415-1-10)																							CONTRACT NO.
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		09511	SUSPENDED ACOUSTICAL CE																					
		1.5A	SHOP DRAWINGS		X									X										
		1.5B	PRODUCT DATA	X										X										
		1.5C	SAMPLES								X			X										
		1.5D	MANF. INSTRUCTIONS			X							X											
		1.6A	GRID MANF. QUALIFICATIONS									X	X											
		1.6B	UNIT MANF. QUALIFICATIONS									X	X											
		09650	RESILIENT FLOORING																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X									X											
		1.4C	SAMPLES								X			X										
		1.4D	MANF. INSTRUCTIONS			X							X											
		1.7A	MAINTENANCE DATA	X									X											
		09651																						
		09690	CARPET TILE																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X									X											
		1.4C	SAMPLES								X		X											
		1.4D	MANF. INSTRUCTIONS			X							X											
		1.5A	MANF. QUALIFICATIONS									X	X											
		1.5B	APPLICATOR QUALIFICATION									X	X											
		09900	PAINTING																					
		1.5A	PRODUCT DATA	X									X											
		1.5B	SAMPLES								X		X											
		1.5C	MANF. INSTRUCTIONS			X							X											
		1.6A	MANF. QUALIFICATIONS									X	X											
		1.6B	APPLICATOR QUALIFICATION									X	X											
		09955	WALL COVERINGS																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X									X											
		1.4C	SAMPLES								X			X										
		1.4D	TEST REPORTS						X				X											
		1.4E	MANF. INSTRUCTIONS			X							X											
		1.5A	MANF. QUALIFICATIONS									X	X											

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TITLE AND LOCATION														CONTRACTOR								SPECIFICATION SECTIO
TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL									CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
				DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION	ONLY / GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.5B	APPLICATOR QUALIFICATION									X	X											
		10105	VISUAL DISPLAY BOARDS																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X									X											
		1.4C	SAMPLES								X			X										
		1.5A	MAINTENANCE DATA	X									X											
		1.6A	MANF. QUALIFICATIONS									X	X											
		1.7A	WARRANTY									X	X											
		10160	TOILET COMPARTMENTS																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X									X											
		1.4C	SAMPLES								X			X										
		1.4D	MANF. INSTRUCTIONS			X							X											
		10260	WALL AND CORNER PROTEC																					
		1.2A	SHOP DRAWINGS											X										
		1.2B	PRODUCT DATA											X										
		1.2C	CERTIFICATES											X										
		1.2D	SAMPLES											X										
		10440	SIGNS																					
		1.4A	PRODUCT DATA	X									X											
		1.4B	SHOP DRAWINGS		X									X										
		1.4C	CERTIFICATES							X			X											
		1.4D	SAMPLES								X			X										
		10508	MTL WARDROBE LOCKERS																					
		1.4A	PRODUCT DATA	X									X											
		1.4B	SHOP DRAWINGS		X									X										
		1.4C	SAMPLES								X			X										
		10522	FIRE EXT, CAB, & ACCS																					
		1.4A	SHOP DRAWINGS		X									X										
		1.4B	PRODUCT DATA	X									X											
		1.4C	MANF. INSTRUCTIONS			X							X											
		1.4D	MANF. CERTIFICATE							X			X											
		1.5A	MAINTENANCE DATA	X									X											
		10550	POSTAL SPECIALTIES																					

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				TYPE OF SUBMITTAL										CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS		INFORMATION ONLY	GOVERNMENT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.		n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.3A	PRODUCT DATA												X										
		1.3B	SHOP DRAWINGS												X										
		1.3C	SAMPLES												X										
		1.3D																							
		10552	MTL STORAGE SHELVING																						
		1.3A	SHOP DRAWINGS		X										X										
		1.3B	SAMPLES								X				X										
		1.3C	SEISMIC CALCULATIONS	X										X											
		1.4A	MANF. QUALIFICATIONS									X		X											
		1.4B	INSTALLER QUALIFICATIONS									X		X											
		1.6A	WARRANTY									X		X											
		1.7A	MAINTENANCE INSTRUCTION									X		X											
		10605	WIRE MESH PARTITIONS																						
		1.4A	SHOP DRAWINGS		X										X										
		1.4B	PRODUCT DATA	X											X										
		1.4C	SAMPLES								X				X										
		1.4D	MANF. INSTRUCTIONS			X								X											
		10753	WALL MTD. TELE. ENC.																						
		1.4A	SHOP DRAWINGS		X										X										
		1.4B	PRODUCT DATA	X											X										
		1.5A	MANF. QUALIFICATIONS									X		X											
		10800	TOILET & BATH ACCS.																						
		1.4A	PRODUCT DATA	X											X										
		1.5B	SAMPLES								X				X										
		1.4C	MANF. INSTRUCTIONS			X								X											
		11133	PROTECTION SCREENS																						
		1.4A	PRODUCT DATA	X											X										
		1.4B	SHOP DRAWINGS		X										X										
		11134	PROJ. SCREEN (MAN OP)																						
		1.4A	PRODUCT DATA	X											X										
		1.4B	SHOP DRAWINGS		X										X										
		12390	CABINETS AND COUNTERTOP																						
		1.4A	MANF. DATA	X										X											

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				TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
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		1.4B	DRAWINGS		X									X										
		1.4C	TEST REPORTS						X				X											
		1.4D	SAMPLES								X		X											
		12512	HOR. LOUVER BLINDS																					
		1.5A	SHOP DRAWINGS		X									X										
		1.5B	PRODUCT DATA	X									X											
		1.5C	SAMPLES								X		X											
		1.5D	MANF. INSTRUCTIONS			X							X											
		1.6A	MANF. QUALIFICATIONS									X	X											
		12690	RECESSED ENTRY MAT																					
		1.2A	MANF. DATA	X										X										
		1.2B	COLOR CHARTS								X			X										
		1.2C	DRAWINGS		X									X										
		1.2D	O & M MANUALS									X		X										
		14245	HYD. ELEVATORS-PASS.																					
		1.8A	SHOP DRAWINGS		X								X											
		1.8B	PRODUCT DATA	X									X											
		1.8C	SAMPLES								X			X										
		1.9	O & M DATA	X									X											
		1.11A	MANF. QUALIFICATIONS									X	X											
		1.11B	INSTALLER QUALIFICATIONS									X	X											
		1.15	WARRANTY									X	X											
		15010	BASIC MECHANICAL REQUIREMENT																					
		1.6C	MAINTENANCE MANUALS									X		X										
		15121	PIPING EXPANSION COMP.																					
		1.5D	DESIGN DATA	X										X										
		1.5E	MANF. INSTRUCTIONS			X								X										
		1.5C	WELDER'S CERTIFICATE							X				X										
		1.5B1	FLEXIBLE PIPE CONNECTORS				X							X										
		1.5B2	EXPANSION JOINTS				X							X										
		1.8A	MANF. QUALIFICATIONS									X		X										
		15140	SUPPORTS AND ANCHORS																					
		1.6C	PRODUCT DATA	X										X										
		1.6D	DESIGN DATA	X										X										
		1.6B	SHOP DRAWINGS		X									X										
		1.6E	MANF. INSTRUCTIONS			X								X										
		1.6G	PIPE HANGER SCHEDULE				X							X										

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				DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.8A	WELDER'S CERTIFICATE							X				X										
		15140	SLEEVES AND FLASHINGS																					
		1.6D	PRODUCT DATA	X										X										
		1.6B	SHOP DRAWINGS		X								X											
		1.6E	MANF. INSTRUCTIONS			X							X											
		1.6F	WELDER'S CERTIFICATES							X			X											
		15170	ELECTRIC MOTORS																					
		1.4B	PRODUCT DATA	X										X										
		1.4D	MANF. INSTRUCTIONS			X							X											
		1.4C	TEST TEPORTS						X				X											
		15190	MECHANICAL IDENTIFICATION																					
		1.5D	PRODUCT DATA	X										X										
		1.5E	MANF. INSTRUCTIONS			X							X											
		1.5C	VALVE SCHEDULE				X							X										
		15245	VIBRATION ISOLATION																					
		1.6F	MAINTENANCE DATA	X																				
		1.6C	PRODUCT DATA	X										X										
		1.6B	SHOP DRAWINGS		X								X											
		1.6D	MANF. INSTRUCTIONS			X							X											
		1.6E	MANF. CERTIFACATES							X			X											
		15260	PIPING INSULATION																					
		1.5B	PRODUCT DATA	X										X										
		1.5E	MANF. INSTRUCTIONS			X							X											
		1.5D	TEST REPORTS						X				X											
		1.5C	MATERIAL CERTIFICATES							X			X											
		15280	BREECHING INSULATION																					
		1.5B	PRODUCT DATA	X										X										
		1.5E	MANF. INSTRUCTIONS			X							X											
		1.5D	TEST REPORTS						X				X											
		1.5C	MATERIAL CERTIFICATES							X			X											
		15280	EQUIPMENT INSULATION																					
		1.5B	PRODUCT DATA	X										X										
		1.5E	MANF. INSTRUCTIONS			X							X											
		1.5D	TEST REPORTS						X				X											
		1.5C	MATERIAL CERTIFICATES							X			X											
		15290	DUCTWORK INSULATION																					
		1.5A	PRODUCT DATA	X										X										
		1.5D	MANF. INSTRUCTIONS			X							X											
		1.5C	TEST REPORTS						X				X											
		1.5B	MATERIAL CERTIFICATES							X			X											

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TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		15330	WET-PIPE SPRINKLER SYSTEM																					
		1.3E	AS-BUILT DRAWINGS		X								X											
		1.3B	HYDRAULIC CALCULATIONS	X										D1										
		1.3I	MATERIALS AND TEST CERT.							X			X											
		1.3C	SPARE PARTS	X									X											
		1.3D	SPRINKLER SYS DRAWINGS		X									D1										
		1.3J	SPRINKLER SYSTEM			X							X											
		1.3A	SPRINKLER SYSTEM EQUIP.	X										D1										
		1.3F	TEST PROCEDURES			X							X											
		1.3G	TESTS				X							D1										
		15332	PREACT. DELUGE SPRINKLER																					
		1.4B	CALCULATIONS	X										D1										
		1.4C	CALCULATIONS	X										D1										
		1.4J	MATERIAL AND TEST CERT.							X			X											
		1.4D	SPARE PARTS	X									X											
		1.4E	SPRINKLER SYSTEM DRAWINGS		X									D1										
		1.4A	SPRINKLER SYSTEM EQUIP.	X										D1										
		1.4H	TESTS				X							D1										
		15410	PLUMBING PIPING																					
		1.5A	DOMESTIC WTR PIPING SYS	X										X										
		1.5A	NATURAL GAS PIPING SYSTEM	X										X										
		1.5A	SANITARY SEWER PIPING SYS	X										X										
		15430	PLUMBING SPECIALTIES																					
		15430	CATCH BASINS AND MANHOLES																					
		1.6B	PRODUCT DATA	X										X										
		1.6A	SHOP DRAWINGS		X								X											
		1.6C	MANF. INSTRUCTIONS			X							X											
		1.6D	MANF. CERTIFICATES							X			X											
		15430	PLUMBING SPECIALTIES																					
		1.6B	PRODUCT DATA	X										X										
		1.6A	SHOP DRAWINGS		X								X											
		1.6C	MANF. INSTRUCTIONS			X							X											
		1.6D	MANF. CERTIFICATES							X			X											
		15440	PLUMBING FIXTURES																					
		15440	ELECTRIC WATER COOLERS																					
		1.6A	PRODUCT DATA	X										X										
		1.6B	MANF. INSTRUCTIONS			X							X											
		15440	EMERGENCY SHOWERS																					
		1.6A	PRODUCT DATA	X										X										
		1.6B	MANF. INSTRUCTIONS			X							X											
		15440	PLUMBING FIXTURES																					
		1.6A	PRODUCT DATA	X										X										

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TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.6B	MANF. INSTRUCTIONS			X							X											
		15450	PLUMBING EQUIPMENT																					
		1.4B	PRODUCT DATA	X										X										
		1.4A	SHOP DRAWINGS		X								X											
		1.4C	MANF. INSTRUCTIONS			X							X											
		15450	PUMPS AND ACCESSORIES																					
		1.4B	PRODUCT DATA	X										X										
		1.4A	SHOP DRAWINGS		X								X											
		1.4C	MANF. INSTRUCTIONS			X							X											
		1.4B	REPORTS						X				X											
		15481	COMPRESSED AIR SYSTEM																					
		1.4B	PRODUCT DATA	X										X										
		1.4A	SHOP DRAWINGS		X									X										
		1.4D	MANF. INSTRUCTIONS			X							X											
		1.4C	TEST REPORTS						X				X											
		15481	QUICK CONNECT COUPLINGS											X										
		1.4B	PRODUCT DATA	X																				
		1.4A	SHOP DRAWINGS		X								X											
		1.4D	MANF. INSTRUCTIONS			X							X											
		1.4C	TEST REPORTS						X				X											
		15510	HYDRONIC PIPING																					
		15510	CHILL WTR PIPEING SYS																					
		1.5A	PRODUCT DATA	X										X										
		1.5C	MANF. INSTRUCTIONS			X							X											
		1.5B	WELDERS CERTIFICATE							X			X											
		15510	CONDENS. WTR PIPING SYS																					
		1.5A	PRODUCT DATA	X										X										
		1.5C	MANF. INSTRUCTIONS			X							X											
		1.5B	WELDERS CERTIFICATE							X			X											
		15510	HOT WTR PIPING SYS																					
		1.5A	PRODUCT DATA	X										X										
		1.5C	MANF. INSTRUCTIONS			X							X											
		1.5B	WELDERS CERTIFICATE							X			X											
		15515	HYDRONIC SPECIALTIES																					
		15515	HEAT TRACING																					
		1.4A	PRODUCT DATA	X										X										
		1.4C	MANF. INSTRUCTIONS			X							X											
		1.4B	INSPECTION CERTIFICATE							X			X											
		15515	HYDRONIC SPECIALTIES																					
		1.4A	PRODUCT DATA	X										X										
		1.4C	MANF. INSTRUCTIONS			X							X											
		1.4B	INSPECTION CERTIFICATE							X			X											

SUBMITTAL REGISTER (ER415-1-10)																CONTRACT NO.								
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TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
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		15540	HVAC PUMPS																					
		1.5A	PRODUCT DATA	X										X										
		1.5B	MANF. INSTRUCTIONS			X							X											
		1.5C	MILLWRIGHT'S CERTIFICATE							X			X											
		15545	CHEMICAL WATER TREATMENT																					
		15545	CLOSED SYS WTR TREATMENT																					
		1.5B	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X									X										
		1.5C	MANF. INSTRUCTIONS			X							X											
		1.5E	MANF. FIELD REPORTS						X					X										
		1.5F	CERTIFICATE							X			X											
		15545	CONDENS. WTR SYS TREATMENT																					
		1.5B	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X									X										
		1.5C	MANF. INSTRUCTIONS			X							X											
		1.5E	MANF. FIELD REPORTS						X					X										
		1.5F	CERTIFICATE							X			X											
		15545	WATER SOFTENERS																					
		1.5B	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X									X										
		1.5C	MANF. INSTRUCTIONS			X							X											
		1.5E	MANF. FIELD REPORTS						X					X										
		1.5F	CERTIFICATE							X			X											
		15556	HEATING SYSTEM																					
		1.2A	PRODUCT DATA	X										X										
		1.2C	HEATING SYS DRAWINGS		X								X											
		1.2D	FRAMED INSTRUCTIONS			X							X											
		1.2E	PERFORMANCE TESTS				X							X										
		1.2A	SPARE PARTS	X									X											
		1.2B	WELDING PROCEDURES							X			X											
		15569	HEATING SYSTEM																					
		1.3A	MANF. CATALOG DATA	X										X										
		1.3C	HEATING SYS DRAWINGS		X								X											
		1.3D	POSTED INSTRUCTIONS			X							X											
		1.3B	SPARE PARTS DATA	X									X											
		1.3E,F	TESTS				X							X										
		15575	BREECHINGS & CHIMNEYS																					
		1.6B	PRODUCT DATA	X										X										
		1.6A	SHOP DRAWINGS		X									X										
		1.6C	INSTALLATION INSTRUCTIONS			X							X											
		15682	CHILLER PACKAGE																					
		1.4B	PRODUCT DATA	X										X										

SUBMITTAL REGISTER (ER415-1-10)																CONTRACT NO.								
TITLE AND LOCATION															CONTRACTOR									SPECIFICATION SECTIO
				TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.4A	SHOP DRAWINGS		X									X										
		1.4D	INSTALLATION INSTRUCTIONS			X							X											
		1.4C	CERTIFICATION							X			X											
		15835	TERMINAL HEAT TRANS UNITS																					
		1.5B	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X								X											
		1.5E	INSTALLATION INSTRUCTIONS			X							X											
		1.5C	SCHEDULES				X							X										
		15850	VARIABLE FREQUENCY DRIVES																					
		1.4A	PRODUCT DATA	X										X										
		15855	AHU WITH COILS																					
		15855	COOLING COILS																					
		1.5B	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X								X											
		1.5C	INSTALLATION INSTRUCTIONS			X							X											
		15855	HEATING COILS																					
		1.5B	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X								X											
		1.5C	INSTALLATION INSTRUCTIONS			X							X											
		15855	HUMIDIFIERS																					
		1.5B	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X								X											
		1.5C	INSTALLATION INSTRUCTIONS			X							X											
		15855	PACKAGED AHU																					
		7	PRODUCT DATA	X										X										
		1.5A	SHOP DRAWINGS		X								X											
		1.5C	INSTALLATION INSTRUCTIONS			X							X											
		15860	CENTRIFUGAL FANS																					
		1.4B	PRODUCT DATA	X										X										
		1.4A	SHOP DRAWINGS		X								X											
		1.4C	INSTALLATION INSTRUCTIONS			X							X											
		15865	AXIAL FANS																					
		1.4B	PRODUCT DATA	X										X										
		1.4A	SHOP DRAWINGS		X								X											
		15870	POWER VENTILATORS																					
		1.4A	PRODUCT DATA	X										X										
		1.4B	MANF. INSTRUCTIONS			X							X											
		15885	AIR CLEANING DEVICES																					
		15885	AIR FILTERS																					
		1.5C	PRODUCT DATA	X										X										

SUBMITTAL REGISTER (ER415-1-10)																CONTRACT NO.								
TITLE AND LOCATION															CONTRACTOR									SPECIFICATION SECTIO
				TYPE OF SUBMITTAL										CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.5B	SHOP DRAWINGS		X								X											
		1.5D	INSTALLATION INSTRUCTIONS			X							X											
		15885	DEHUMIDIFIERS																					
		1.5C	PRODUCT DATA	X										X										
		1.5B	SHOP DRAWINGS		X								X											
		1.5D	INSTALLATION INSTRUCTIONS			X							X											
		15890	DUCTWORK																					
		1.6B	PRODUCT DATA	X										X										
		1.6A	SHOP DRAWINGS		X									X										
		1.6D	INSTALLATION INSTRUCTIONS			X							X											
		1.6C	TEST REPORTS						X					X										
		15910	DUCTWORK ACCESSORIES																					
		1.4B	PRODUCT DATA	X										X										
		1.4A	SHOP DRAWINGS		X								X											
		1.4C	INSTALLATION INSTRUCTIONS			X							X											
		15930	VAV TERMINAL UNITS																					
		1.6B	PRODUCT DATA	X										X										
		1.6A	SHOP DRAWINGS		X								X											
		1.6D	INSTALLATION INSTRUCTIONS			X							X											
		1.6C	SCHEDULE				X							X										
		15940	AIR OUTLETS AND INLETS																					
		15940	AIR DEVICES																					
		1.5A	PRODUCT DATA	X										X										
		15940	KITCHEN HOODS																					
		1.5A	PRODUCT DATA	X										X										
		15950	HVAC CONTROL SYSTEMS																					
		15950	CONTROL DAMPERS																					
		1.3A	PRODUCT DATA	X										X										
		1.3J	SCHEDULE				X							X										
		15950	CONTROL SYSTEM																					
		1.3A	PRODUCT DATA	X										X										
		1.3D	SHOP DRAWINGS		X									X										
		1.3L	SERVICE ORGAN. INSTRUCT			X							X											
		1.3A	CONTROL SYSTEM							X			X											
		15950	CONTROL SYSTEM TRAINING																					
		1.3B	TRAINING			X							X											
		15950	CONTROL VALVES																					
		1.3A	PRODUCT DATA	X										X										
		1.3I	SCHEDULES				X							X										
		15950	HVAC CONTROL SYSTEMS																					
		1.3A	PRODUCT DATA	X										X										
		1.3E,F,G	SHOP DRAWINGS		X									X										

SUBMITTAL REGISTER (ER415-1-10)																						CONTRACT NO.
TITLE AND LOCATION														CONTRACTOR								SPECIFICATION SECTIO
				TYPE OF SUBMITTAL									CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.3H	SCHEDULES			X							X											
		1.3M	REPORTS						X					X										
		1.3A	CERTIFICATES							X			X											
		1.3N	RECORDS									X	X											
		15950	TEST, COMISS., & BALANCE										X											
		1.3M	INSTRUCTIONS			X																		
		1.3M	STATEMENTS					X					X											
		1.3M	REPORTS						X					X										
		1.3N	CERTIFICATES							X			X											
		1.3N	RECORDS									X	X											
		15980	INSTRUMENTATION																					
		15980	GAGES																					
		1.5A	PRODUCT DATA	X										X										
		1.5D	MANF. INSTRUCTIONS			X							X											
		1.5B	CERTIFICATES							X			X											
		15980	METERS																					
		1.5A	PRODUCT DATA	X										X										
		1.5D	MANF. INSTRUCTIONS			X							X											
		1.5B	CERTIFICATES							X			X											
		15990	TEST, ADJUST, & BALANCE																					
		1.5B,C,F,G	REPORTS						X					X										
		1.5D,E	TEST, ADJUST, & BALANCE									X	X											
		16111	CONDUIT																					
		1.4A	CONDUIT	X										X										
		1.4A	CONDUIT BODY	X										X										
		1.4A	CONDUIT FITTINGS	X										X										
		16114	CABLE TRAYS																					
		1.3A	TRAY TYPE		X									X										
		1.3A	DIMENSIONS		X									X										
		1.3A	SUPPORT		X									X										
		1.3A	FINISH		X									X										
		1.3B	FITTINGS	X										X										
		1.3C	GENERAL INSTRUCTIONS			X							X											
		16115	INDOOR SERVICE POLES																					
		1.3A	MATERIALS	X										X										
		1.3A	FINISHES	X										X										
		1.3A	CONFIGURATION	X										X										
		1.3A	ATTACHMENT DETAILS	X										X										
		1.3B	GENERAL INSTRUCTIONS			X							X											
		16123	BLDG WIRE & CABLE																					
		1.4A	WIRE AND CABLE	X										X										

SUBMITTAL REGISTER (ER415-1-10)																						CONTRACT NO.
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		1.4A	WIRING CONNECTORS	X										X										
		1.4A	HEAT SHRINK MATERIAL	X										X										
		1.4A	INSULATING TAPE	X										X										
		1.4A	WIRE PULLING LUBRICANT	X										X										
		1.4B	INSTALLATION			X							X											
		16130	BOXES																					
		1.3A	OUTLETS	X										X										
		1.3C	BOXES	X										X										
		16140	WIRING DEVICES																					
		1.4A	SWITCHES	X										X										
		1.4A	DIMMERS	X										X										
		1.4A	RECEPTACLES	X										X										
		1.4A	FLOOR SERVICE FITTINGS	X										X										
		1.4A	POKE-THRU FITTINGS	X										X										
		1.4A	PHOTOCELL	X										X										
		1.4A	INSTALLATION			X							X											
		16170	GROUNDING AND BONDING																					
		1.6A	ROD ELECTRODES	X										X										
		1.6A	MECHANICAL CONNECTORS	X										X										
		1.6A	EXOTHERMIC CONNECTIONS	X										X										
		1.6A	GROUNDING WELL	X										X										
		1.5B	RESISTANCE TESTS						X				X											
		1.5C	GENERAL INSTRUCTIONS			X							X											
		16180	EQUIP. WIRING SYSTEMS																					
			CONTROL WIRING	X										X										
		16190	SUPPORTING DEVICES																					
		1.4A	SUPPORTING DEVICES	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16195	ELECTRICAL ID																					
		1.4A	NAMEPLATE	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16441	ENCLOSED SWITCHES																					
		1.4A	SWITCH	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16461	DRY TYPE TRANSFORMERS																					
		1.4A	TRANSFORMER	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16470	PANELBOARDS																					

SUBMITTAL REGISTER (ER415-1-10)																						CONTRACT NO.
TITLE AND LOCATION														CONTRACTOR								SPECIFICATION SECTIO
				TYPE OF SUBMITTAL									CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
TRANS-MITTAL NO.	ITEM NO.	SPECIFICATION & PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
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		1.4A	PANELBOARD	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16477	FUSES																					
		1.4A	ELECTRICAL CHARACTERISTICS	X										X										
		16481	ENCLOSED MOTOR CONTROL																					
		1.4A	PRODUCT DATA	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16485	CONTRACTORS																					
		1.4A	PRODUCT DATA	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16476	ENCLOSED CIRCUIT BREAKERS																					
		1.4A	ENCLOSED CIRCUIT BREAKERS	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		16510	INTERIOR LIGHTING																					
		1.4A	FIXTURES	X										X										
		1.4A	BALLAST	X										X										
		1.4A	EMERGENCY UNIT	X										X										
		1.4A	EXIT SIGN	X										X										
		1.4A	EMERGENCY UNIT (FLU	X										X										
		1.4A	LAMPS	X										X										
		1.4B	GENERAL INSTRUCTIONS			X							X											
		1.4C	GENERAL INSTRUCTIONS			X							X											
		16670	LIGHT PROTECT. SYSTEM																					
		1.5A	EQUIPMENT		X									X										
		1.5B	DIMENSIONS/MATERIAL	X										X										
		16721	FIRE ALARM SYSTEMS																					
		1.5A	LAYOUTS/WIRING		X									D1										
		1.5B	CONTROL PANEL	X										D1										
		1.5B	INITIATION DEVICES	X										D1										
		1.5B	AUXILIARY DEVICES	X										D1										
		1.5B	WIRING	X										D1										
		1.5C	INSTALLATION		X								X											
		1.5D	FIRE DEPT. REVIEW	X										X										
		1.5E	FIRE DEPT. COMMENTS	X										X										
		16741	INTER. PHONE, DATA & VOICE																					
		1.5A	CABLE/PATCH CORDS																					
		1.5A	CONNECTOR BLOCKS																					
		1.5A	PATCH PANELS																					
		1.5A	MODULAR JACKS																					

SUBMITTAL REGISTER (ER415-1-10)																						CONTRACT NO.
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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.5A	WALL PLATES																					
		1.5B	TEST	X										X										

SUBMITTAL REGISTER

(ER 415-1-10)

CONTRACT NO.:

TITLE AND LOCATION

CONTRACTOR:

SPECIFICATION SECTION: 00700 & 00800

ACTIVITY NO	TRANSMITTAL NO.	ITEM NO	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL									CLASSIFICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
					DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	O&M MANUALS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERNMENT	CODE	DATE	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
			00800-9.0	As-Built Drawings		X										X										
			00800-10.1	Equip.-in-Place List	X										X											
			00800-10.2	Maint. & Parts Data	X										X											
			00800-12.1.3	Small Tool Useage Plan						X					X											
			00800-15.2	SF1413	X										X											
			00800-20.1.7	Warranties					X		X				X											
			00800-40	Lbr., Equip, & Matl.																						
				Rpts for Ext. Work						X						X										
			00800-42	Progress Photographs	X										X											
			00800-45	Insurance Certification							X				X											
			00800-61	Mech. Rm. Layout		X										X										
			00700-88	Accident Prevention Plan						X						X										
			00700-89	Construction Schedule				X								X										

ENG FORM 4288-R, JAN 97 **EDITION OF MAR 95 IS OBSOLETE.** PAGE ____ OF ____ PAGES (Proponent: CEMP-CE)

WAIS Document RetrievalGENERAL DECISION MA990002 07/16/99 MA2
General Decision Number MA990002

Superseded General Decision No. MA980002

State: Massachusetts

Construction Type:
BUILDING
HEAVY
MARINE

County(ies):
WORCESTER

BUILDING CONSTRUCTION PROJECTS (Does not include residential construction consisting of single family homes and apartments up to and including 4 stories); HEAVY CONSTRUCTION PROJECTS; AND MARINE CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	03/12/1999
1	05/21/1999
2	06/04/1999
3	06/11/1999
4	06/18/1999
5	06/25/1999
6	07/16/1999

COUNTY(ies):
WORCESTER

ASBE0006E 09/01/1998

	Rates	Fringes
INSULATOR/ASBESTOS WORKER Includes the application of all insulating materials, protective coverings, coating, and finishes to all types of mechanical systems	22.19	10.08

BOIL0029A 01/01/1997

	Rates	Fringes
BOILERMAKERS	23.28	12%+8.69

BRMA0001B 12/01/1998

	Rates	Fringes
WORCESTER (Warren)		
BRICKLAYERS; CEMENT MASONS; PLASTERERS; STONEMASONS	21.70	7.77

BRMA0001N 09/01/1998

	Rates	Fringes
WORCESTER (Auburn Barre, Blackstone, Berlin, Bolton, Boylston,		

the Brookfields, Charlton, Clinton, Douglas, Dudley, Grafton, Hardwick, Holden, Leicester, Mendon, Millbury, Milville, New Braintree, Northboro, Northbridge, Oakham, Oxford, Paxton, Rutland, Shrewbury, SOuthbridge, Spencerr, Sturbridge, Sutton, Upton, Uxbridge, Webster, Westboro, West Boylston, Worcester)

BRICKLAYERS; CEMENT MASONS; PLASTERERS; STONEMASONS	24.91	12.84

BRMA0001O 02/01/1998

	Rates	Fringes
WORCESTER (Hopedale, Milford, Southboro)		
BRICKLAYERS; CEMENT MASONS; PLASTERERS; STONEMASONS	26.46	11.94

BRMA0003A 07/01/1998

	Rates	Fringes
MARBLE, TILE & TERRAZZO WORKERS	27.25	11.02
TERRAZZO FINISHERS	30.40	6.60
MARBLE & TILE FINISHERS	22.13	10.85

BRMA0003O 09/01/1997

	Rates	Fringes
WORCESTER (Ashburnham, Athol, Fitchburg, Gardner, Harvard, Hubbardston, Lancaster, Leominster, Lunenburg, Petersham, Phillipston, Princeton, Royalston, Sterling, Templeton, Westminster, Winchendon)		
BRICKLAYERS; CEMENT MASONS; PLASTERERS; STONEMASONS	25.36	11.39

CARP0056D 08/01/1998

	Rates	Fringes
DIVERS	34.01	10.91

CARP0056H 04/01/1999

	Rates	Fringes
PILEDRIVERMEN & DIVERS TENDERS	22.82	10.91

CARP0107B 04/01/1999

	Rates	Fringes
WORCESTER (Except Gilbertville, Hardwick, Warren, West Brookfield)		
CARPENTERS AND LATHERS	21.38	10.11

CARP0108A 04/05/1999

	Rates	Fringes
WORCESTER (Gilbertville, Hardwick, Warren, West Brookfield)		
CARPENTERS AND LATHERS	20.28	8.74

CARP1121A 04/01/1999

	Rates	Fringes
MILLWRIGHTS	23.71	12.16

CARP2168C 04/01/1999

	Rates	Fringes
SOFT FLOOR LAYERS	21.99	10.21

ELEC0007A 01/01/1999

	Rates	Fringes
WORCESTER (Warren)		
ELECTRICIANS	23.05	3%+7.60

ELEC0096B 12/01/1998

	Rates	Fringes
WORCESTER (Except Warren)		
ELECTRICIANS	24.44	8.46+3%
TELEDATA SYSTEM INSTALLERS	17.06	6.55

ELEC0104A 09/01/1998

	Rates	Fringes
LINE CONSTRUCTION:		
Lineman	26.00	7.96+3%+A

FOOTNOTES:

A. PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Christmas Day and Columbus Day, provided the employee has been employed 5 working days prior to any one of the listed holidays.

ELEV0041B 10/01/1998

	Rates	Fringes
ELEVATOR MECHANICS	29.145	6.67+A

FOOTNOTE:

A. Employer contributes 8% of basic hourly rate as vacation pay credit for employees with 5 years or more of service and 6% for 6 months to 5 years of service. Paid holidays: New years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day

* ENGI0004C 06/01/1999

	Rates	Fringes
WORCESTER (Except Athol, Barre, Brookfield, East Brookfield, Hardwick, New Braintree, North Brookfield, Oakham, Petersham, Phillipston, Royalston, Strutbridge, Templeton, Warren, West Brookfield, Winchendon)		
POWER EQUIPMENT OPERATORS BUILDING HEAVY & MARINE):		
GROUP 1	26.77	10.62+A
GROUP 2	26.60	10.62+A
GROUP 3	21.11	10.62+A
GROUP 4	23.69	10.62+A
GROUP 5	17.84	10.62+A
GROUP 6	19.42	10.62+A

HOURLY PREMIUM FOR BOOM LENGTHS (Including Jib):
Over 150 ft. +1.17
Over 185 ft. +2.06
Over 210 ft. +2.89
Over 250 ft. +4.38

Over 295 ft. +6.07

POWER EQUIPMENT OPERATORS CLASSIFICATIONS
BUILDING AND HEAVY CONSTRUCTION

GROUP 1: Power shovel; crane; truck crane; derrick; pile driver; trenching machine; mechanical hoist pavement breaker; cement concrete paver; dragline; hoisting engine; three drum machine; pumpcrete machine; loaders; shovel dozer; front end loader; mucking machine; shaft hoist; steam engine; backhoe; gradall; cable way; fork lift; cherry picker; boring machine; rotary drill; post hole hammer; port hole digger; asphalt plant on job site; concrete batching and/or mixing plant on job site; crusher plant on job site; paving concrete mixer; timber jack

GROUP 2: Sonic or vibratory hammer; grader; scraper; tandem scraper; bulldozer; tractor; mechanic - maintenance; York rake; mulching machine; paving screed machine;stationary steam boiler; paving concrete finishing machine; grout pump; portable steam boiler; portable steam generator; roller; spreader; asphalt paver; locomotives or machines used in place thereof; tamper (self propelled or tractor-draw); cal tracks; ballast regulator;rail anchor machine; switch tamper; tire truck

GROUP 3: Pumps (1-3 grouped); compressor; welding machines (1-3 grouped); generator; sighting plant; heaters (power driven, 1-5); syphon-pulsometer; concrete mixer; valves controlling permanent plant air steam, conveyor, wellpoint system (operating)

GROUP 4: Assitant engineer (fireman)

GROUP 5: Oiler (other than truck cranes and gradalls)

GROUP 6: Oiler (on truck cranes and gradalls)

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

MARINE CONSTRUCTION

GROUP 1: Shovel; crane; truck crane; cherry picker; derrick; pile driver; two or more drum machines; lighters; derrick boats; trenching machines; mechanic hoist pavement breakers; cement concrete pavers; draglines; hoisting engines; pumpcrete machines; elevating graders; shovel dozer; front end loader; backhoe; gradall; cable ways; boring machine; rotary drill; post hole hammer; post hole digger; fork lift; timber jack; asphalt plant (on site); concrete batching and/or mixing plant (on site); crusher plant (on site); paving concrete mixer

GROUP 2: Portable steam boiler; portable steam generator; sonic or vibratory hammer; grader; scraper; tandem scraper; concrete pump; bulldozer; tractor; York rake; mulching machine; roller; spreader; tamper (self-propelled or tractor-drawn); asphalt paver; concrete mixer with side loader; mechanic - maintenance; cal tracks; ballast regulator; switch tamper; rail anchor

machine; tire truck

GROUP 3: Pumps (1-3 grouped); comressor; welding machines (1-3 grouped); generator; lighting plant; heaters (power driven 1-5); syphon-pulsometer; concrete mixer; valves controlling permanent plant air or steam; conveyor; well point systems; auger (powered by independent engines and attached to pile drivers); hydraulic saws

GROUP 4: Fireman

GROUP 5: Assistant engineer (other than truck crane and gradall)

GROUP 6: Assistant engineer (on truck crane and gradall)

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:

A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day

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* ENGI0004G 06/01/1999

	Rates	Fringes
WORCESTER (Area East of a line formed by the Eastern boundaries of the following townships: Barre, Brookfield, East Brookfield, North Brookfield, Oakham, Sturbridge, Templeton, and Winchendon)		
POWER EQUIPMENT OPERATORS (BUILDING):		
GROUP 1	26.77	10.62+A
GROUP 2	26.60	10.62+A
GROUP 3	21.11	10.62+A

HOURLY PREMIUM FOR BOOM LENGTHS (Including Jib):

Over 150 ft	+1.17
Over 185 ft	+2.06
Over 210 ft	+2.89
Over 250 ft	+4.38

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoe, Front End Loader, Crane

GROUP 2: Bulldozer

GROUP 3: Pumps

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:
A. Paid Holidays: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day

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ENGI0098E 06/01/1998

	Rates	Fringes
WORCESTER (Athol, Barre, Brookfield, East Brookfield, Hardwick, New Braintree, North Brookfield, Oakham, Petersham, Phillipston, Royalston, Strubridge, Templeton, Warren, West Brookfield, Winchendon)		
POWER EQUIPMENT OPERATORS (HEAVY CONSTRUCTION):		
Group 1	22.88	6.65+B
Group 2	22.62	6.65+B
Group 3	22.42	6.65+B
Group 4	21.93	6.65+B
Group 5	19.71	6.65+B
Group 6	18.77	6.65+B
Group 7	17.13	6.65+B
Group 8	23.78	6.65+B
Group 9	18.42	6.65+B
Group 10	23.79	6.65+B
Group 11	23.70	6.65+B
Group 12	24.32	6.65+B

HAZARDOUS WASTE PREMIUM $1.50

POWER EQUIPMENT OPERATORS CLASSIFICATIONS
HEAVY CONSTRUCTION

Group 1: Shovels; crawler and truck cranes; derricks; backhoes; trenching machines; elevating graders; belt type loaders; gradalls; piledrivers; concrete pavers, on-site processing plant (engineer in charge); dragline; clamshell; cableways; shaft hoists; mucking machines; front end loader 5 1/2 cu yd and over; tower cranes; self propelled hydraulic cranes, 10 tons and over; dual pavers; automatic grader, excavator C.M.I. or equal; scrapers towing pan or wagon, tandem dozers or push cats (2 units in tandem); welder using semi-aautomatic welding machine; shotcrete machine; tunnel boring machine; combination backhoe/loader, 3/4 cu yd hoe or over; jet engine dryer; tree shredder; post hole digger; post hole hammer; post extractor; truck mounted concrete pumps with boom; roto-mill

Group 2: Rotary drill with mounted compressor; compressor house, 3 to 6 compressors; rock and earth boring machines, excluding

McCarthy and similar drills; grader; front end loaders, 4 yds to 5 1/2 yds; scraper, 21 yds and over (struck load); forklifts 7 ft lift and over or 3 ton capacity and over; sonic hammer console; road planer; cal tracks; ballast regulators; rail anchor machines; swith tampers

Group 3: Bulldozer; push cats; scrapers up to 21 yds, struck load, self propelled or tractor drawn; self powered asphalt paver; front end loaders up to 4 yds; mechanics, welders; well driller; pumpcrete machine; engineer or fireman on high pressure boiler (on job); self loading batch plant (on job); well point

operator; electric pumps used in well point system; tireman; pumps 16 inch or over total discharge; compressors (1 or 2) 900 cu ft and over; powered grease truck; tunnel locomotives and dinkeys; grout pumps; hydraulic jacks (jacking pipe, slip forms, etc.); boom truck, self-propelled hydraulic cranes up to 10 tons; combination backhoe/loader up to 3/4 cu yd hoe

Group 4: Asphalt rollers; self-powered rollers and compactors; tractor without blade drawing sheeps foot roller; rubber tire roller; vibratory roller or other type of compactors including machines for pulverizing and aerating soil

Group 5: Hoists; conveyors; power pavement breaker; self-propelled material spreader; self-powered concrete finishing machine; two bag mixer with skip; McCarthy and similar drills; batch plant (not self-loading); bulk cement plant; 3 or more 10 KW light plants; 30 KW or more generator

Group 6: Compressor, 315 cu ft to 900 cu ft, 1 or 2; pumps 4 inches to 16 inches total discharge

Group 7: Compressor up to 315 cu ft; small mixers with skip; oiler; pumps up to 4 inches; grease truck; power heaters; welding machines when 3 or more welding machines are used; A-frame trucks; forklifts up to 7 ft lift and up to 3 ton capacity; hydro boom; power safety boat

Group 8: Truck crane crews

Group 9: Oiler

Group 10: Master mechanic

Group 11: Boom lengths over 184 feet including jib

Group 12: Boom lengths over 225 feet including jib

FOOTNOTES FOR POWER EQUIPMENT OPERATORS

A. Paid Holidays: New year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Christmas Day

B. Paid Holidays: New year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day.

ENGI0098F 06/01/1998

	Rates	Fringes
WORCESTER (Area west of a line formed by the Eastern boundaries of the following Townships: Barre, Brookfield, East Brookfield, North Brookfield, Oakham, Sturbridge, Templeton, and Winchendon)		
POWER EQUIPMENT OPERATORS (BUILDING)		
GROUP 1	22.88	6.65+A
GROUP 2	21.62	6.65+A
GROUP 3	22.42	6.65+A
GROUP 4	21.93	6.65+A

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoe; Front End Loader, 5 1/2 cu yd and over; Crane

GROUP 2: Front End Loader, 4 cu yd to 5 1/2 cu yd

GROUP 3: Bulldozer; Front End Loader up to 4 cu yd

GROUP 4: Roller, all types

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:
A. Paid Holidays: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day

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IRON0057C 05/01/1999

	Rates	Fringes
IRONWORKERS	25.90	12.00

LABO0022A 06/01/1998

	Rates	Fringes
LABORERS (HEAVY CONSTRUCTION):		
Group 1	18.95	7.45
Group 2	19.20	7.45
Group 3	19.70	7.45
Group 4	19.95	7.45
Group 5	13.05	7.45
Group 6	20.95	7.45

LABORERS CLASSIFICATIONS

Group 1: Laborers; carpenter tenders; cement finisher tenders

Group 2: Asphalt raker; fence and guard rail erector; laser beam operator; mason tender; pipelayer; pneumatic drill operator; pneumatic tool operator; wagon drill operator

Group 3: Air track operator; block paver; rammer; curb setter

Group 4: Blaster; powderman

Group 5: Flagger

Group 6: Asbestos Abatement; Toxic and Hazardous Waste Laborers

LABO0022M 06/01/1999

	Rates	Fringes
LABORERS (TUNNELS, CAISSON & CYLINDER WORK IN COMPRESSED AIR)		
GROUP 1	20.70	7.20+A
GROUP 2	31.18	7.20+A
GROUP 3	31.18	7.20+A
GROUP 4	31.18	7.20+A
GROUP 5	33.18	7.20+A

LABORERS CLASSIFICATIONS

GROUP 1: Powder watchman; Top man on iron bolt; change house attendant
GROUP 2: Brakeman; trackman; groutman; laborer; outside lock tender; lock tender; guage tender
GROUP 3: Motorman
GROUP 4: Blaster
GROUP 5: Mucking machine operator

LABORERS (FREE AIR OPERATION): SHIELD DRIVEN AND LINER PLATE IN FREE AIR)		
GROUP 1	23.25	7.20+A
GROUP 2	23.25	7.20+A

LABORERS CLASSIFICATIONS

GROUP 1: Miner; miner welder; conveyor operator; motorman; mucking machine operator; nozzle man; grout man; shaft and tunnel steel and rodman; shield and erector arm operators
GROUP 2: Brakeman; trackman

CLEANING CONCRETE AND CAULKING TUNNEL (Both New & Existing)		
GROUP 1	23.25	7.20+A
GROUP 2	23.25	7.20+A

LABORERS CLASSIFICATIONS

GROUP 1: Concrete workers; strippers and form movers (wood & steel rock shaft, concrete lining of same and tunnel in free air
GROUP 2: Form erector

ROCK SHAFT, CONCRETE LINING OF SAME AND TUNNEL IN FREE AIR		
GROUP 1	20.70	7.20+A
GROUP 2	23.25	7.20+A
GROUP 3	23.25	7.20+A
GROUP 4	23.25	7.20+A

LABORERS CLASSIFICATIONS

GROUP 1: Change house attendants
GROUP 2: Laborers, topside
GROUP 3: Brakeman; trackman; tunnel laborers; shaft laborers
GROUP 4: Miner; cage tender; bellman

LABORERS (OPEN AIR CAISSONS, UNDERPINNING AND TEST BORING INDUSTRIES):

OPEN AIR CAISSON, UNDERPINNING WORK & BORING CREW		
Laborers; Top man	20.75	7.20+A
Bottom man	21.70	7.20+A
TEST BORING & WELL DRILLING		
Laborer	20.75	7.20+A
Driller	22.15	7.20+A

FOOTNOTE FOR LABORERS:
A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day

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LABO1421C 06/01/1999

	Rates	Fringes
WRECKING LABORERS:		
Yardmen Laborer (Salvage Yard only)	16.85	7.95
Yardmen Burners, Sawyers	19.95	7.95
Wrecking Laborers	20.85	7.95
Adzeman	20.85	7.95
Burners, Jackhammers	21.10	7.95
Small Front Loaders on Tracks and Bobcat Operators	21.35	7.95
Asbestos Removers	22.85	7.95

PAIN0035F 01/01/1999

	Rates	Fringes
PAINTERS:		
NEW CONSTRUCTION:		
Brush, Taper	22.17	9.02
Spray, Sandblast	23.17	9.02
Bridge	30.01	9.02
REPAINT		
Brush, Taper	19.13	9.02
Spray, Sandblast	20.13	9.02
Bridge	30.01	9.02

PAIN0035R 06/01/1998

	Rates	Fringes
SIGN PAINTERS	16.38	6.02

PAIN1044B 10/17/1997

	Rates	Fringes
WORCESTER		
GLAZIERS	25.21	9.60

PLUM0004B 03/01/1999

	Rates	Fringes
WORCESTER (Except Hopedale and Southboro)		
PLUMBERS & PIPEFITTERS	23.46	9.20

PLUM0012B 03/01/1999

	Rates	Fringes
WORCESTER (Hopedale and Southboro)		
PLUMBERS	28.22	11.68

SFMA0669B 04/01/1999

	Rates	Fringes
SPRINKLER FITTERS	25.53	6.40

SHEE0017D 01/01/1998

	Rates	Fringes
WORCESTER (Harvard, Lancaster)		
SHEET METAL WORKERS	20.59	11.04

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* SHEE0063B 07/01/1999

	Rates	Fringes
WORCESTER (Except Harvard & Lancaster)		
SHEET METAL WORKERS	21.50	10.96

SUMA1001A 05/01/1989

	Rates	Fringes
BUILDING CONSTRUCTION ONLY:		
LABORERS:		
Unskilled	12.71	3.60
Landscape	8.28	
TRUCK DRIVERS, 2-AXLE	11.77	

TEAM0379C 12/01/1998

	Rates	Fringes
TRUCK DRIVERS		
(EXCEPT BUILDING CONSTRUCTION):		
Group 1	21.03	8.36+A+B
Group 2	21.20	8.36+A+B
Group 3	21.27	8.36+A+B
Group 4	21.39	8.36+A+B
Group 5	21.49	8.36+A+B
Group 6	21.78	8.36+A+B
Group 7	22.07	8.36+A+B

TRUCK DRIVERS CLASSIFICATIONS

Group 1: Station wagons; panel trucks; and pickup trucks
Group 2: Two axle equipment; & forklift operator
Group 3: Three axle equipment and tireman
Group 4: Four and Five Axle equipment
Group 5: Specialized earth moving equipment under 35 tons other than conventional type trucks; low bed; vachual; mechanics, paving restoration equipment
Group 6: Specialized earth moving equipment over 35 tons
Group 7: Trailers for earth moving equipment (double hookup)

POWER TRUCKS $.25 DIFFERENTIAL BY AXLE
TUNNEL WORK (UNDERGROUND ONLY) $.40 DIFFERENTIAN BY AXLE

FOOTNOTES:

A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day, & Christmas Day

B. PAID VACATION: Employees with 4 months to 1 year of service receive 1/2 day's pay per month; 1 week vacation for 1 - 5 years of service; 2 weeks vacation for 5 - 10 years of service; and 3 weeks vacation for more than 10 years of service

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

SECTION 01090

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the sponsoring organization, e.g. UL 1 (1993; Rev thru Jan 1995) Flexible Metal Conduit. However, when the sponsoring organization has not assigned a number to a document, an identifying number has been assigned for convenience, e.g. UL's unnumbered 1995 edition of their Building Materials Directory is identified as UL-01 (1995) Building Materials Directory. The sponsoring organization number (UL 1) can be distinguished from an assigned identifying number (UL-01) by the lack of a dash mark (-) in the sponsoring organization assigned number.

1.2 ORDERING INFORMATION

The addresses of the organizations whose publications are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the sponsoring organization should be ordered from the source by title rather than by number.

ACI INTERNATIONAL (ACI)

P.O. Box 9094
Farmington Hills, MI 48333-9094
Ph: 248-848-3800
Fax: 248-848-3801
Internet: http://www.aci-int.org

AGRICULTURAL MARKETING SERVICE (AMS)
Seed Regulatory and Testing Branch
USDA, AMS, LS Div.
Room 209, Bldg. 306, BARC-East
Beltsville, MD 20705-2325
Ph: 301-504-9430
Fax: 301-504-5454 Internet: http://www.ams.usda.gov/lsg/ls-sd.htm
e-mail: james_p_triplitt@usda.gov

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
4301 North Fairfax Dr., Suite 425
ATTN: Pubs Dept.
Arlington, VA 22203
Ph: 703-524-8800
Fax: 703-528-3816
E-mail: ari@ari.org
Internet: www.ari.org

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)
1712 New Hampshire Avenue, NW
Washington, DC 20009

Ph: 202-483-9370
FAX: 202-234-4721

AIR DIFFUSION COUNCIL (ADC)
104 So. Michigan Ave., No. 1500
Chicago, IL 60603
Ph: 312-201-0101
Fax: 312-201-0214

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)
30 W. University Dr.
Arlington Heights, IL 60004-1893
Ph: 708-394-0404
Fax: 708-253-0088

ALUMINUM ASSOCIATION (AA)
Pubs Department
P.O. Box 753
Waldorf, MD 20601
Ph: 301-645-0756
Fax: 301-843-0159
Internet: www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Ofc. Sq.
Suite 104
Schaumburg, IL 60173-4268
Ph: 847-303-5664
Fax: 847-303-5774
Internet: www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 N. Capital St., NW, Suite 249
Washington, DC 20001
Ph: 800-231-3475
Fax: 800-525-5562
Internet: www.aashto.org
NOTE: AASHTO documents with numbers beginning with M or T are available only in Standard Specifications for Transportation Materials and Methods of Samplingand Testing, 199~~7~~8 @$289.00\X

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
P.O. Box 12215
1 Davis Drive
Research Triangle Park, NC 27709-2215
Ph: 919-549-8141
Fax: 919-549-8933

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)
1200 19th Street, NW, Suite 300
Washington, DC 20036-4303
Ph: 202-429-5155
Fax: 202-223-4579

AMERICAN BOILER MANUFACTURERS ASSOCIATION (ABMA)
950 N. Glebe Rd., Suite 160
Arlington, VA 22203-1824

Ph: 703-522-7350
Fax: 703-522-2665

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)
222 West Las Colinas Blvd., Suite 641
Irving, TX 75039-5423
Ph: 972-506-7616
Fax: 972-506-7682
Internet: http://www.concrete-pipe.org
e-mail: info@concrete-pipe.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Dr.
Cincinnati, OH 45240-1634
Ph: 513-742-2020
Fax: 513-742-3355
Internet: www.acgih.org
E-mail: pubs@acgih.org

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)
American Wood Council
ATTN: Publications Dept.
1111 Nineteenth St. NW, Suite 800
Washington, DC 20036
Ph: 800-294-2372
Fax: 202-463-2791
Internet: http://www.~~awc~~afandpa.org
Order From: American Wood Council
P.O. Box 5364
Madison, WI 53705-5364
Ph: 800-890-7732
Fax: 608-231-2152

AMERICAN GAS ASSOCIATION (AGA)
Order from: AGA Distribution Center
P.O. Box 79230
Baltimore, MD 21279-0230
Ph: 301-617-7819
Fax: 301-206-9789

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)
1500 King St., Suite 201
Alexandria, VA 22314-2730
Ph: 703-684-0211
Fax: 703-684-0242
Order From:
Global Engineering Documents
15 Inverness Lane East
Englewood, CO 80112
Ph: 800-854-7179
Fax: 303-397-2740

AMERICAN HARDBOARD ASSOCIATION (AHA)
1210 W. Northwest Highway
Palatine, IL 60067
Ph: ~~708~~847-934-8800
Fax: ~~708~~847-934-8803

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)
2700 Prosperity Ave., Suite 250
Fairfax, VA 22031
Ph: 703-849-8888
Fax: 703-207-3561
Internet: http://www.aiha.org
E-mail: www.aiscweb.com

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Dr., Suite 3100
Chicago, IL 60601-2001
Ph: 312-670-2400
Publications: 800-644-2400
Fax: 312-670-2400
Internet: http://www.aiscweb.com

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)
7012 So. Revere Parkway, Suite 140
Englewood, CO 80112
Ph: 303-792-9559
Fax: 303-792-0669

AMERICAN IRON AND STEEL INSTITUTE (AISI)
ATTN: Publication Orders
P.O. Box 4321
Chestertown, MD 21690
Ph: 800-277-3850
Fax: 410-810-0910

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
11 West 42nd St
New York, NY 10036
Ph: 212-642-4900
Fax: 212-398-0023
Internet: www.ansi.org/
Note: Documents beginning with the letter "S" can be ordered from:
Acoustical Society of America
P. O. Box 1020
Sweickley, PA 15143-9998
Ph: 412-741-1979
Fax: 412-741-0609
Internet: www.aip.org

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)
1250 I St., NW, Suite 500
Washington, DC 20005
Ph: 202-789-2900 Ext 3010
FAX: 202-789-1893

AMERICAN PETROLEUM INSTITUTE (API)
1220 L St., NW
Washington, DC 20005
Ph: 202-682-8375
Fax: 202-962-4776
Internet: http://www.api.org

AMERICAN RAILWAY ENGINEERING & MAINTENANCE-OF-WAY ASSOCIATION (AREMA)
8201 Corporate Dr., Suite 1125
Landover, MD 20785

Ph: 301-459-3200
Fax: 301-459-8077

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)
1711 Arlingate Lane
P.O. Box 28518
Columbus, OH 43228-0518
Ph: 800-222-2768
Fax: 614-274-6899

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
Ph: 610-832-9500
Fax: 610-832-9555
Internet: www.astm.org
NOTE: The annual ASTM Book of Standards (66 Vol) is available for $3500.00. Prices of individual standards vary.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20190-4400
Ph: 800-548-2723
Fax: 703-295-6333
Internet: www.pubs.asce.org
e-mail: marketing@asce.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Cir., NE
Atlanta, GA 30329-2305
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
Internet: http://www.ashrae.org

AMERICAN SOCIETY OF SANITARY ENGINEERING FOR PLUMBING AND SANITARY RESEARCH (ASSE)
P.O. Box 40362
Bay Village, OH 44140
Ph: 216-835-3040
Fax: 216-835-3488
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PART 2 NOT USED

PART 3 NOT USED

SECTION 01330

SUBMITTAL PROCEDURES

1 GENERAL

1.1 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers as follows:

SD-01 Data

SD-04 Drawings

SD-06 Instructions

SD-07 Schedules

SD-08 Statements

SD-09 Reports

SD-13 Certificates

SD-14 Samples

SD-18 Records

SD-19 Operation and Maintenance Manuals

1.2 SUBMITTAL DEFINITIONS

Definitions of submittals used in Corps of Engineers guide specifications (CEGS-Series) are as follows:

SD-01 Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

SD-04 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

SD-06 Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-07 Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

SD-08 Statements

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

SD-09 Reports

Reports of inspections or tests, including analysis and interpretation of test results.

SD-13 Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

SD-14 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-18 Records

Documentation to record compliance with technical or administrative requirements.

SD-19 Operation and Maintenance Manuals

Data which forms a part of an operation and maintenance manual.

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.3.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.3.3 Review of Construction Contractor Submittals

All submittals for Government Approval will also contain one of the following designations, "D1", "D2", "D3", or "X", in the remarks column of Form 4288.

D1 - A Contractor design in which the project designer maintains final and total responsibility for the design.

D2 - A Contractor design in which the design liability is passed to the Contractor.

D3 - Fire Protection/Life Safety Submittals (excluding sprinkler design).

X - Any other submittal for which Government Approval is desired.

1.4 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor's Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.5 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.6 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 GENERAL

The Contractor shall [make submittals as required by the specifications] [submit all items listed on the Submittal Register (ENG 4288) as incorporated in RMS.]. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the Contractor's Quality Control (CQC) <CHG/> System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2 SUBMITTAL REGISTER (ENG FORM 4288)

At the end of Section 01330, SUBMITTAL PROCEDURES, is one set of ENG Form 4288 listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. [The Contractor will also be given the submittal register as a diskette containing the computerized ENG Form 4288 and instructions on the use of the diskette. Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" and "s" through "u" and submit the forms (hard copy plus associated electronic file) to the Contracting Officer for approval within 30 calendar days after Notice to Proceed.] [The form will also be found in the RMS software package to be utilized by the Contractor. The Contractor shall update the RMS Submittal Register by completing the columns for Contractor Schedule Dates and Activity Numbers and return three hard copies to the Contracting Officer for approval within 30 calendar days after Notice to Proceed.] [The Contractor shall keep this diskette up-to-date and shall submit it to the Government together with the monthly payment request.] The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated. NOTE: The Contractor is required to add additional entries to the Submittal Register for all items requiring multiple submittals, including Formwork Shop Drawings per Lift, Concrete Reinforcement per Lift, Concrete Lift Drawings per Lift, Multiple Shop Assembly Drawings, etc. These entires

should be made prior to original submission of the Submittal Register within 30 days of Notice to Proceed.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 30 calendar days shall be allowed and shown on the register for review and approval of submittals for [food service equipment] [and] [refrigeration and HVAC control systems].

3.4 ALL SUBMITTAL WHICH EXCEED THE DETAIL SHOWN ON THE CONTRACT DRAWINGS

a. SPECIAL CONTRACT REQUIREMENTS, Paragraph 9, As-Built Drawings, also require submittal details or drawings which exceed that which is shown on the contract drawings to be transmitted in electronic format. All such submittals must include, along with the hard copy of the drawings required above, CADD files of the submittal in a commercially available format, such as Microstation or AutoCadd, for incorporating into as-built or record drawings.

b. These submittals include those that reflect structural details, foundation layouts, equipment, sizes, mechanical room layouts, and other similar data, including all extensions of design, which were not shown or have changed from the original drawings.

3.5 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached at the end of Section 00800 shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.6 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.6.1 Procedures

Submittal shall be made as follows:

The Contractor shall submit to the Contracting Officer eight (8) copies of all submittals of items requiring shop inspection and six (6) copies of all other submittals as called for under the various headings of these specifications.

3.6.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.7 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.8 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Three copies of the submittal will be retained by the Contracting Officer and three copies of the submittal will be returned to the Contractor.

3.9 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.10 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR (Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or sheet(s) attached.
SIGNATURE: _____
TITLE: _____
DATE: _____

SECTION 01410

ENVIRONMENT PROTECTION

PART 1 GENERAL

1.1 SUMMARY (NOT APPLICABLE)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTALS.

SD-08 Statements

Environmental Protection Program; GA.

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall submit in writing his detailed proposal for implementing requirements for environmental pollution control specified herein.

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall:

(1) Submit in writing his detailed proposal for implementing the requirements for environmental pollution control specified herein.

(2) Meet the representatives of the Contracting Officer to review and alter his proposal as needed for compliance with the environmental pollution control program.

Preconstruction Survey; FIO.

Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey, after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs, and grassed areas immediately adjacent to the site of the work and adjacent to his assigned storage area and access routes(s) as applicable. This report will be signed by both the Contracting Officer and Contractor upon mutual agreement as to its accuracy and completeness.

Waste Disposal Scheme; FIO.

As part of his proposed implementation under Paragraph 3.2, and prior to onsite construction, the Contractor shall submit a description of his scheme for disposing of waste materials resulting from the work under this contract. If any waste material is dumped in unauthorized area, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed areas. Where directed, contaminated ground shall be excavated, disposed of as approved, and replaced with suitable fill material, all at the expense of the Contractor.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall perform all work in such manner as to minimize the pollution of air, water, or land, and shall, within reasonable limits, control noise and the disposal of solid waste materials, as well as other pollutants.

3.2 IMPLEMENTATION

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall meet the representatives of the Contracting Officer to review and alter his proposal as needed for compliance with the environmental pollution control program.

3.3 PROTECTION OF LAND AREAS

Except for any work on storage areas and access routes specifically assigned for the use of the Contractor under this contract, the land areas outside the limits of permanent work performed under this contract shall, in accordance with CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURE, UTILITIES AND IMPROVEMENTS, be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work on the plans or specifically assigned for his use. In accordance with CONTRACT CLAUSE: OPERATIONS AND STORAGE AREAS, storage and related areas and access routes required temporarily by the Contractor in the performance of the work will be assigned by the Contracting Officer. No other areas on Government premises shall be used by the Contractor without written consent of the Contractor Officer.

3.4 PROTECTION OF TREES AND SHRUBS

CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES AND IMPROVEMENTS, is hereby supplemented as follows: The Contractor shall not deface, injure or destroy trees or shrubs, nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage.

3.4.1 Tree Protective Structures

Where, in the opinion of the Contracting Officer, trees may possibly be defaced, bruised, injured or otherwise damaged by the Contractor's equipment or by his other operations, he may direct the Contractor to provide temporary protection of such trees by placing boards, plans, or poles around them.

3.4.2 Restoration of Damaged Trees

Any tree scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the

Contractor's expense. All scars made on trees not designated on the plans to be removed by construction operations shall be coated as soon as possible with an approved tree wound dressing. Trees that are to remain, either within or outside established clearing limits, that are damaged by the Contractor so as to be beyond saving in the opinion of the Contracting Officer, shall be immediately removed, if so directed, and replaced with a nursery-grown tree of the same species and size.

3.5 PROTECTION OF WATER RESOURCES

The Contractor shall control the disposal of fuels, oils, bitumens, calcium chloride, acids, or harmful materials, both on and off the Government premises, and shall comply with applicable Federal, State, County and Municipal laws concerning pollution of rivers and streams while performing work under this contract. Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, herbicides and insecticides from entering public waters. Water used in onsite material processing, concrete curing, foundation and concrete cleanup, and other waste waters shall not be allowed to reenter a stream if an increase in the turbidity of the stream could result therefrom.

3.6 ACTIVITY ENVIRONMENTAL ANALYSIS

Before starting any major phase of the work, an Activity Environmental Analysis shall be developed by the contractor and reviewed with the Government Representative. A major phase of the work is defined as an operation involving a type of work not previously experienced which presents possible sources of adverse environmental effects. This analysis will evaluate potential environmental consequences of the activity and the techniques which will be utilized to accomplish the work in an acceptable manner. This analysis included: (1) the phase or activity or work; (2) the potential environmental consequences of the activity; (3) precautionary actions to prevent adverse environmental impacts; (4) actions in the event of an environmental incident; and (5) the appropriate reference to Federal, State, or Local standards, regulations, or laws.

3.7 BURNING

Air pollution restrictions applicable to this project are as follows. Materials shall not be burned on the Government premises. If the Contractor elects to dispose of waste materials off the Government premises, by burning, he shall make his own arrangements for such burning area and shall, as specified in CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES, conform to all local regulations.

3.8 DUST CONTROL

The Contractor shall maintain all excavations, stockpiles, access roads, waste areas, and all other work free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to the Using Service or to others. Approved temporary methods consisting of sprinkling, chemical treatment, or similar methods will be permitted to control dust. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

3.9 EROSION CONTROL

Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall be graded to control erosion within acceptable limits. Temporary control measures shall be provided and maintained until permanent drainage facilities are completed and operative. The area of bare soil exposed at any one time by construction operations, should be held to a minimum.

3.10 WASTE DISPOSAL

a. Scrap metals shall be delivered to the convenience centers for recycling. The metals can be steel, aluminum, brass, copper and bronze. Containers (55 gallon drums, 5 gallon cans, etc.) that have contained petroleum, antifreeze, paint, acid, etc., cannot be accepted as scrap metal at this time. The containers shall be emptied of any liquid contents in accordance with applicable regulations and then flattened and placed in dumpsters at the convenience centers.

b. Wooden pallets and cardboard must be segregated from debris going to the Government construction landfill. The wooden pallets must be transported to either the convenience center located at 11th Street and Stillwell Road, or the convenience center located at 47th Street and Range Road.

c. The cardboard must be taken to the recycle plant (Bldg. 5225) or to either of the two convenience centers mentioned above.

d. The Government construction and debris landfill will not accept debris contaminated with wood pallets or cardboard. The contractor is responsible for separation of these materials or transportation to an off-post landfill.

3.11 CORRECTIVE ACTION

The Contractor shall, upon receipt of a notice in writing of any noncompliance with the foregoing provisions, take immediate corrective action. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs of damages by the Contractor unless it was later determined that the Contractor was in compliance.

3.12 POST-CONSTRUCTION CLEANUP OR OBLITERATION

In accordance with CONTRACT CLAUSE: CLEANING UP, the Contractor shall, unless other wise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed areas shall be graded and filled and the entire area seeded.

3.13 PAYMENT

No separate payment or direct payment will be made for the cost of the work covered under this section, and such work will be considered as a subsidiary obligation of the Contractor.

-- End of Section --

SECTION 01451

CONTRACTOR QUALITY CONTROL

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(1995b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 QUALITY CONTROL PLAN - DESIGN

The Contract shall furnish for review by the government, not later than 10 days after Notice to Proceed, the Contractor Quality Control Plan for the design portion of the contract. The professional quality, technical

accuracy and the coordination of all design documents and other services to be provided by the prime Contractor and subcontractor/consultants is of major importance. A logical and functional quality control program requiring technical and interdisciplinary reviews to eliminate errors and deficiencies in the design documents is required. As a minimum, the design Quality Control Plan will address the following elements:

Management Approach - Define the specific management-methodology to be followed during the design phase of the work including the relationship between prime contractor and subcontractors/consultants. Address coordination, quality control, communications and lines of responsibility.

Management Structure - Delineate the organizational structure and interrelationship of management and the design team including all subcontractor and consultants. Identify the key design and review team members showing their specific responsibilities. Either the designer or the reviewer must be a registered professional for the Architectural, Civil, Structural, Mechanical and Electrical disciplines.

List submittals required, dates for submittal, dates for completion of Government review and products required to be submitted.

Designer or Engineer of Record (EOR) - The registered professional ultimately responsible and liable for adequacy and safety of the design. EOR signature is required on all shop drawings.

3.3 QUALITY CONTROL PLAN

3.3.1 General

The Contractor shall furnish for review by the Government, not later than 30days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, s records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.3.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.3.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and

operations including removal of personnel, as necessary, to obtain the quality specified.

3.3.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.4 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 30 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4.1 Subcontractor CQC Orientation

Before a Subcontractor begins work on the jobsite, the CQC System Manager will train the Subcontractor by showing the video tape entitled "CQC - A Bridge (or Pathway) to Success" and answering any questions pertaining to quality control operations. This requirement is waived only if a Subcontractor attended the initial coordination meeting described above. A copy of this video can be borrowed from the Contracting Officer. A record of the orientation shall be documented in the QC Report.

3.5 QUALITY CONTROL ORGANIZATION

3.5.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.5.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of

CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be [a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of [_____] years construction experience on construction similar to this contract.] [a construction person with a minimum of [_____] years in related work.] This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be [assigned no other duties] [assigned as System Manager but may have duties as project superintendent in addition to quality control.] An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.5.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: [electrical,] [mechanical,] [civil,] [structural,] [environmental,] [architectural,] [materials technician,] [submittals clerk,] [occupied family housing coordinator]. These individuals [shall be directly employed by the prime Contractor and may not be employed by a supplier or sub-contractor on this project] [may be employees of the prime or subcontractor]; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals [shall have no other duties other than quality control.] [may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan].

Experience Matrix

	Area	Qualifications
a.	Civil	Graduate Civil Engineer with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience
b.	Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 yrs related experience
c.	Electrical	Graduate Electrical Engineer with 2 yrs related experience or person with 5 yrs related experience
d.	Structural	Graduate Structural

		Engineer with 2 yrs experience or person with 5 yrs related experience
e.	Architectural	Graduate Architect with 2 yrs experience or person with 5 yrs related experience
f.	Environmental	Graduate Environmental Engineer with 3 yrs experience
g.	Submittals	Submittal Clerk with 1 yrs experience
h.	Occupied family housing	Person, customer relations type, coordinator experience
i.	Concrete, Pavements and Soils	Materials Technician with 2 yrs experience for the appropriate area

3.5.4 Additional Requirement

In addition to the above experience [and] [and/or] education requirements the CQC System Manager shall have completed and passed the course entitled "Construction Quality Management For Contractors". This course is periodically offered by the Associated Builders and Constructors, Inc., or Associated General Contractor, Inc.

3.5.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.6 SUBMITTALS

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverablesare in compliance with the contract requirements.

3.7 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.7.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Resolve all differences.

k. Discussion of the initial control phase.

l. The Government shall be notified at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.7.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.7.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.7.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if : the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.8 TESTS

3.8.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the

Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.8.2 Testing Laboratories

3.8.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.8.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $1375.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.8.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the

Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the U.S. Army Engineer Waterways Experiment Station, f.o.b., at the following address:

Commander and Director
U.S. Army Engineer Waterways Experiment Station
ATTN: CEWES-GS
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

4 COMPLETION INSPECTION

4.1.1 Punch-Out Inspection

Near the end of all work or any increment of the work established by a a time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or by the specifications, the CQC System Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepard and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corredted. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

4.1.2 Pre-Final Inspection

The Government will perform this pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work </chg> if the project is divided into increments by separate completion dates.

4.1.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance

inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

4.2 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be indentified (Preparatory, Initial, follow-up). List of deficiencies noted along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals AND DELIVERABLES reviewed, with contract reference, by whom, and action taken.

g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

k. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

<HL1>l. Deficiency Tracking System. The Contractor shall maintain a cumulative list of deficiencies identified for the duration of the project. Deficiencies to be listed include those failures, Government oral observations and Notifications of Noncompliance. The list shall be maintained at the project site. Copies of updated listings shall be submitted to the Government at least every 30 days.</HL1>

4.3 SAMPLE FORMS [GENERATED BY RMS SOFTWARE]

Sample forms for Daily Construction Quality Control Report and Deficiency List are enclosed at the end of Section 00800 as well as other forms the Contractor may utilize during this project.

4.4 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

1.2.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is

desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection.

1.2.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

1.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. The Contractor shall then remove all the temporary distribution lines, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.2.5 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.6 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 915 by 1220 mm 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.3.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the drawings. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign

shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.4.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.5 CONTRACTOR'S TEMPORARY FACILITIES

1.5.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

1.5.2 Storage Area

The Contractor shall construct a temporary 1.8 m 6 foot high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored [green] [brown], so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.5.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 3.6 m 12 feet in width, 5 m 16 feet in length and have a minimum of 2.1 m 7 feet headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building

shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 11 degrees C 20 degrees F below the outside temperature when the outside temperature is 35 degrees C 95 degrees F, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

1.5.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.6 GOVERNMENT FIELD OFFICE

1.6.1 Resident Engineer's Office

The Contractor shall provide the Government Resident Engineer with an office, approximately 19 square meters 200 square feet in floor area, located where directed and providing space heat, electric light and power, and toilet facilities consisting of one lavatory and one water closet complete with connections to water and sewer mains. A mail slot in the door or a lockable mail box mounted on the surface of the door shall be provided. At completion of the project, the office shall remain the property of the Contractor and shall be removed from the site. Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of the Contracting Officer.

1.6.2 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds.

1.7 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as

telephone or other suitable devices. The devices shall be made available for use by Government personnel.

1.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 1.1 m 42 inches high, supported and tightly secured to steel posts located on maximum 3 m 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

1.9 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.10 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

PART 2 NOT APPLICABLE

PART 3 NOT APPLICABLE

---End of Section---

SECTION 01570

TEMPORARY CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. 29 CFR 1910 - Occupational Safety and Health Standards

B. 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response

C. 29 CFR 1926 - Safety and Health Regulations for Construction

D. 29 CFR 1926-SUBPART V - Power Transmission and Distribution

E. 40 CFR 122.26 - EPA National Pollutant Discharge Elimination System Permit Regulations

F. 40 CFR 261 - Identification and Listing of Hazardous Waste

G. 40 CFR 262 - Generators of Hazardous Waste

H. 40 CFR 263 - Transporters of Hazardous Waste

I. 40 CFR 264 - Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

J. 40 CFR 265 - Interim Status Standard for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

K. 40 CFR 300 - National Oil and Hazardous Substances Pollution Contingency Plan

L. 49 CFR 171 - General Information, Regulations, and Definitions

M. 49 CFR 172 - Hazardous Materials, Tables, and Hazardous Materials Communications Regulations

N. 49 CFR 178 - Shipping Container Specification

O. COE EM-385-1-1 - Safety and Health Requirements Manual

P. COE EP 1165-2-304 - Flood Plain Regulations for Flood Plain Management

Q. EPA 832-R-92-005 - Storm Water Management for Construction Activities

R. NFPA 241 - Safeguarding Construction, Alteration, and Demolition Operations

1.2 CONTRACTOR LIABILITIES FOR ENVIRONMENTAL PROTECTION

A. Government installations must comply with environmental protection laws including but not limited to; the Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act, and the Federal Facilities Compliance Act. The Federal Environmental Protection Agency (EPA) has granted inspection and enforcement authority to State and local governments. Inspection by an EPA agency may include questioning of Contractor personnel who are working with or have contact with hazardous materials and waste. Contractors shall complete and provide environmental training documentation for training required by Federal, State, and local regulations.

1.3 DEFINITIONS

A. Sediment: Soil and other debris that have eroded and have been transported by runoff water or wind.

B. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials, except hazardous waste as defined in paragraph entitled "Hazardous Waste," resulting from industrial, commercial, and agricultural operations and from community activities.

C. Sanitary Wastes: Wastes characterized as domestic sanitary sewage.

D. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

E. Debris: Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.

F. Chemical Wastes: This includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

G. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

H. Hazardous Waste: Hazardous substances as defined in 40 CFR 261 or as defined by applicable State and local regulations.

I. Hazardous Materials: Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

J. Landscape Features: Trees, plants, shrubs, and ground cover.

K. Lead Acid Battery Electrolyte: The electrolyte substance (liquid medium) within a battery cell.

L. Oily Waste:Petroleum products and bituminous materials.

M. Class I Ozone Depleting Substance (ODS): Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

1. Chlorofluorocarbon-11 (CFC-11)
2. Chlorofluorocarbon-12 (CFC-12)
3. Chlorofluorocarbon-13 (CFC-13)
4. Chlorofluorocarbon-111 (CFC-111)
5. Chlorofluorocarbon-112 (CFC-112)
6. Chlorofluorocarbon-113 (CFC-113)
7. Chlorofluorocarbon-114 (CFC-114)
8. Chlorofluorocarbon-115 (CFC-115)
9. Chlorofluorocarbon-211 (CFC-211)
10. Chlorofluorocarbon-212 (CFC-212)
11. Chlorofluorocarbon-213 (CFC-213)
12. Chlorofluorocarbon-214 (CFC-214)
13. Chlorofluorocarbon-215 (CFC-215)
14. Chlorofluorocarbon-216 (CFC-216)
15. Chlorofluorocarbon-217 (CFC-217)
16. Halon-1211
17. Halon-1301
18. Halon-2402
19. Carbon tetrachloride
20. Methyl chloroform

N. Industrial Hygienist: An Industrial Hygienist must be certified by the American Board of Industrial Hygiene.

1.4 SUBMITTALS: Submit under provisions in Section 01300.

A. Statements:

1. Environmental protection plan
2. Preconstruction survey report
3. Health and safety plan
4. MSDS for Class I ODS waivered product
5. Confined space entry procedure
6. Permit for storm water discharge
7. Notice of Intent
8. Notice of Termination

9. Special Safety Plan
10. Pollution Prevention Plan
11. Environmental Quality Board Permits

B. Field Test Reports: Submit a copy of an approved laboratory analysis of materials collected as a result from sandblasting or abrasive blasting operations before disposing of waste materials.

C. Records:

1. Solid waste disposal permit
2. Disposal permit for hazardous waste
3. Environmental training documentation
4. Permit to transport hazardous waste
5. Hazardous waste certification
6. Erosion and sediment control inspection reports

a. Solid Waste Disposal Permit: Submit one copy of a State and local permit or license for the solid waste disposal facility.

b. Disposal Permit for Hazardous Waste: Submit a copy of the applicable EPA and State permits, manifests, or licenses for transportation, treatment, storage, and disposal of hazardous waste by permitted facilities.

c. Permit to Transport Hazardous Waste: Submit one copy of the EPA or State permit license, or regulation for the transporter who will ship the hazardous waste to the permitted Treatment, Storage, and Disposal (TSD) facility.

d. Hazardous Waste Certification: Submit written certification that hazardous waste turned in for disposal was generated on Government property and is identified, packaged, and labeled in accordance with 40 CFR 261, 40 CFR 262, and 40 CFR 263.

e. Erosion and Sediment Control Inspection Reports: Submit to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch of rain.

1.5 ENVIRONMENTAL PROTECTION REGULATORY REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to

correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution.

A. Environmental Protection Plan: Ten days after the award of contract, the Contractor shall meet with the Contracting Officer to discuss the proposed environmental protection plan and to develop mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken.

1. Hazardous materials (HM) to be brought onto the site: Any hazardous materials planned for use on the site shall be included in the Project Hazardous Material Tracking Program maintained by the Safety Department. To assist this effort, the Contractor shall submit a list (including quantities) of HM to be brought to the site and copies of the corresponding material safety data sheets (MSDS). This list shall be submitted to the Contracting Officer. At project completion, any hazardous material brought onto the site shall be removed from the site by the Contractor. The Contractor shall account for the quantity of HM brought to the station, the quantity used or expended during the job, and the leftover quantity which (1) may have additional useful life as a HM and shall be removed by the Contractor, or (2) may be a hazardous waste, which shall then be removed as specified herein.

2. Hazardous waste (HW) generated: The Environmental Protection Plan shall list and quantify any HW to be generated during the project.

3. Storage of hazardous waste: In accordance with state and local regulations, hazardous waste shall be stored near the point of generation up to a total quantity of one quart of acutely hazardous waste or 55 gallons of hazardous waste. Any volume exceeding these quantities shall be moved to a HW permitted area within 3 days. Prior to generation of HW, contact the Contracting Officer for labeling requirements for storage of hazardous wastes.

4. Minimization of hazardous waste: The Contractor should substitute materials as necessary to reduce the generation of HW and include a statement to that effect in the Environmental Plan.

5. Environmental conditions likely to be encountered during

this project: Contact the Contracting officer for conditions in the area of the project which may be subject to special environmental procedures. Include this information in the Preconstruction Survey. Describe in the Environmental Plan any permits required prior to working the area, and contingency plans in case an unexpected environmental condition is discovered.

6. Permitting plans for any transportation and disposal, excavation, or construction of hazardous waste that will required an environmental permit from an issuing agency: The Contractor is responsible for generating the permits and delivering the completed documents to the Contracting Officer. The Contracting Officer will review the permits and the Contractor shall file the documents with the appropriate agency and complete disposal with the approval of the Contracting Officer. Correspondence with the State concerning the environmental permits and completed permits shall be delivered to the Contracting Officer.

   a. Environmental Protection Plan Format: The Environmental Protection Plan shall follow the following format:

ENVIRONMENTAL PROTECTION PLAN

Contracting Organization
Address and Phone Numbers

1. Hazardous materials to be brought onto the site
2. MSDS package
3. Employee training documentation
4. HW storage plan
5. HW to be generated
6. Preconstruction survey results
7. Permitting requirements identified

   b. Environmental Plan Review: Fourteen days after the environmental protection meeting, submit to the Contracting Officer the proposed environmental plan for further discussion, review, and approval.

B. Preconstruction Survey: Perform a preconstruction survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site.

C. Stormwater Pollution Prevention Plan: 40 CFR 122.26, EPA 832-R-92-005. Provide "Stormwater Pollution Prevention Plan."

1. Identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharge from the site.

2. Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge associated with industrial activity at the construction site.

3. Ensure compliance with terms of EPA general permit for storm water discharge.

4. Select applicable management practices from EPA 832-R-92-005.

5. Provide completed copy of Notice of Intent and Notice of Termination except for effective date.

D. Licenses, Permits, and Other Responsibilities: Environmental compliance obligations under the Permits and Responsibilities Clause include, but are not limited to, the following:

1. Understand and perform all requirements under Federal, State, interstate, and local environmental laws, regulations and ordinance that are applicable to the work being performed under this Contract. This responsibility extends to securing all permits as required under such laws, regulations, and ordinances.

2. Advising Contractor's agents, employees, and subcontractor's, who will perform operations, activities, or services under this contract of these requirements.

3. Further:

   a. Notify the Government promptly upon receipt of regulatory notices, orders, or requests for information, and promptly supply copies to the Government.

   b. Comply with environmental regulatory notices or orders to the extent attributable to the Contractor's conduct, regardless of whether or not the Contractor is the name recipient of the notice or order.

   c. Correct conditions of environmental noncompliance identified by the Government in the absence of regulatory noncompliance notices. This includes cleaning up any contamination released from

contractor operations, whether such contamination is on or off Government property.

d. Upon Government request, provide the Government and any regulatory agency with information that may be required regarding the actual or potential environmental impacts of Contractor's operations. The information shall be timely and complete and in a form acceptable to the Government and/or the regulatory agency.

E. Class I ODS Prohibition: Class I ODS as defined and identified herein shall not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition shall be considered to prevail over any other provision, specification, drawing, or referenced documents.

1.6 SAFETY PROGRAM

A. COE EM-385-1-1. Submit safety program, including Accident Prevention Plan, for review and approval 15 calendar days prior to start of work at job site. Conform to the requirements of Federal, State and local laws, rules, and regulations. Work can not proceed until the Safety Program has been approved. The program shall include:

1. 29 CFR 1910.

2. 29 CFR 1926.

3. 29 CFR 1926-SUBPART V, tagout and lockout procedures.

4. COE EM-385-1-1.

5. Contract Clause "FAR 52.236-13, Accident Prevention."

6. Contract Clause "FAR 52.223-3, Hazardous Material Identification and Material Safety Data."

7. MSDS, supply Material Safety Data Sheet for all hazardous materials brought on-site.

8. NFPA 241.

9. When cranes will be needed for lifting steel, add the statement: "Do not hoist two or more separately rigged loads (Tandem or Xmastree lifting), regardless of weight" to the Safety Plan.

B. Work in Confined Spaces: Work in confined spaces. In addition to requirements in Section XXVII of COE EM-385-1-1,

submit a Confined Space Entry Procedure (CSEP) for approval. CSEP shall identify the name and qualifications of the person responsible for testing the confined space work environment. Allow a minimum of 5 working days prior to beginning this work for obtaining approval and any required permits.

1. Entry: Entry into a confined or enclosed space by personnel for any purpose, including hot work, shall be prohibited until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended.

    a. Confined space. Refers to a space which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminants, or which is not intended for continuous employee occupancy. Confined spaces include but are not limited to storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.

    b. Qualified person. A person designated by the Contractor, in writing, as capable (by education or specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions in a confined space. This person shall be capable of specifying necessary control and protective action to ensure worker safety. Where work involves facilities that handle combustible and hazardous materials, this qualified person shall be a NFPA certified marine chemist.

C. Safety Plan Including Accident Prevention

1. Hazardous Material Use: With respect to hazardous materials, safety program shall include provisions to deal with hazardous materials, pursuant to the Contract Clause "FAR 52.223-3, Hazardous Material Identification and Material Safety Data." In addition to FAR 52.223-3, the plan shall consist of:

    a. An index of hazardous materials to be introduced to the site;

    b. Plan for protecting personnel and property during the transport, storage and use of the materials;

c. Procedures for spill response and disposal;

d. Material Safety Data Sheets for materials listed in the index of the plan and not required in the technical section of the specification. Post Material Safety Data Sheets at the worksite where the products will be used.

e. Approved labelling system to identify contents on all containers on site;

f. Personnel training plan.

g. Evidence of compliance with 29 CFR 1910.120 requirements.

Each hazardous material must receive approval prior to bringing onto the job site or prior to any other use in conjunction with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

2. Hazardous Material Exclusions: Notwithstanding any other hazardous material permitted used in this contract, radioactive materials or instruments capable of producing ionizing radiation as well as materials which contain asbestos, mercury, or polychlorinated biphenyls are prohibited. Exceptions to the use of any of the above excluded materials may be considered by the Contracting Officer upon written request by the Contractor.

D. Unforeseen Hazardous Material: If material that is not indicated on the drawings is encountered that may be dangerous to human health upon disturbance during construction operations, stop that portion of work and notify the Contracting Officer immediately. Intent is to identify materials such as PCB, lead paint, and friable and nonfriable asbestos. Within 14 calendar days the Government will determine if the material is hazardous. If the material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If the material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

E. Hazardous Noise: Provide hazardous noise signs, as directed, wherever equipment and work procedures produce sound-pressure levels greater than 85 dBA steady state or 140 dBA impulse, regardless of the duration of the exposure.

1.7 POLLUTION PREVENTION PLAN AND NOTICE OF INTENT

A. The Contractor shall prepare a Pollution Prevention Plan (PPP) and a completed Notice of Intent (NOI) form in accordance with the requirements of the State's general permit for storm water discharges from construction sites.

B. Submit PPP, NOI, and the appropriate permit fee to the Contracting Office a minimum of 14 days prior to start of construction. No work will be allowed on site until an approved permit is received from the State.

C. The Contractor shall keep a copy of the PPP and the approved permit on site at the Contractor's trailer at all times. The PPP shall be continually updated as necessary to reflect current and changing conditions on site.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

A. Land Resources: Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officers permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attach ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage.

1. Protection: Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed.

2. Replacement: Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features.

Obtain Contracting Officer's approval before replacement.

B. Water Resources

1. Stream Crossings: The Contracting Officer's approval is required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition.

2. Oily Wastes: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Surround all temporary fuel oil or petroleum storage tanks with a temporary earth berm of sufficient size and strength to contain the contents of the tanks in the event of leakage or spillage.

C. Fish and Wildlife Resources

1. Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

D. Temporary Construction: Remove traces of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction. Grade temporary roads, parking areas, and similar temporarily used areas to conform with surrounding contours.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

A. Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work.

The Government retains ownership and control over historical and archaeological resources.

3.3 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated

times.

3.4 RESTRICTIONS ON EQUIPMENT

A. Radio Transmitter Restrictions: Conform to the restrictions and procedures for the use of radio transmitting equipment, as directed. Do not use transmitters without prior approval.

3.5 FIRE PROTECTION

A. Compliance: COE EM-385-1-1, NFPA 241, and activity fire regulations. Obtain approval from the local Fire Chief prior to commencement of hot work operations.

B. Fired Kettles: Melt kettles for tar, asphalt, and similar materials shall not be closer than 8 meters 25 feet to buildings or combustible materials. Provide a minimum of two 20 pound ABC all-purpose type extinguishers at the melting kettle and the area of hot material application. Equip kettles with proper heat controls and means of agitation to assure controlled uniform temperatures throughout contents to prevent spot heating. Do not heat contents above flash point.

C. Notification of Fire: Post the local fire poster in conspicuous locations and at telephones in construction shacks.

3.6 EROSION AND SEDIMENT CONTROL MEASURES

A. Local Erosion and Sediment Control Plan: Follow the approved erosion and sediment control plan.

B. Burnoff: Burnoff of the ground cover is not permitted.

C. Borrow Pit Areas: Manage and control borrow pit areas to prevent sediment from entering nearby streams or lakes. Restore areas, including those outside the borrow pit, disturbed by borrow and haul operations. Restoration includes grading, replacement of topsoil, and establishment of a permanent vegetative cover. Uniformly grade side slopes of borrow pit to not more than a slope of 1 part vertical to 2 parts horizontal. Uniformly grade the bottom of the borrow pits to provide a flat bottom and drain by outfall ditches or other suitable means. Stockpile topsoil remove during the borrow pit operation, and use as part of restoring the borrow pit area.

D. Protection of Erodible Soils: Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back

slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

E. Temporary Protection of Erodible Soils: Use the following methods to prevent erosion and control sedimentation:

1. Mechanical Retardation and Control of Runoff: Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and strawbales to retard and divert runoff to protected drainage courses.

2. Sediment Basins: Trap sediment in temporary or permanent sediment basins. Select a basin size to accommodate the runoff of a local 2-year storm. Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs.

3. Borrow: Permit only in areas where suitable environmental controls are possible.

4. Vegetation and Mulch: Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

a. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish a suitable stand of grass. The seeding operation shall be as specified in Section 02935, "Turf."

3.7 CONTROL AND DISPOSAL OF SOLID WASTES

A. Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Contractor is responsible for obtaining and paying for disposal of solid wastes.

B. Disposal of Rubbish and Debris: Dispose of rubbish and

debris in accordance with the requirements specified below:

1. Removal From Government Property: Remove and dispose rubbish and debris from Government property.

C. Sewage, Odor, and Pest Control: Use chemical toilets or comparably effective units, and periodically empty wastes into a municipal, sanitary sewage system, or construct and maintain an approved type of adequate sanitary convenience for the use of persons employed on the work. Include provisions for pest control and elimination of odors.

D. Garbage Disposal: Place garbage in approved containers, and move to a pickup point or disposal area, where directed. Contractor is responsible for obtaining and paying for garbage removal.

3.8 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

A. Hazardous Waste Generation: Handle generated hazardous waste in accordance with 40 CFR 262.

B. Hazardous Waste Disposal: Dispose of hazardous waste in accordance with Federal, State, and local regulations, especially 40 CFR 263, 40 CFR 264, and 40 CFR 265.

C. Hazardous Waste Storage: Store hazardous waste in containers in accordance with 49 CFR 178. Identify hazardous waste in accordance with 40 CFR 261 and 40 CFR 262.

D. Spills of Oil and Hazardous Materials: Take precautions to prevent spills of oil and hazardous material. In the event of a spill, immediately notify the Contracting Officer. Spill response shall be in accordance with 40 CFR 300 and applicable State regulations.

E. Lead-Acid Batteries: Dispose of lead-acid batteries that are not damaged or leaking at a State-approved battery recycle or at a permitted or interim status hazardous waste TSD facility. For lead-acid batteries that are leaking or have cracked casings, dispose of the electrolyte solution using one of the following alternatives:

1. An industrial waste water treatment plant, if available and approved by the Contracting Officer for disposing of lead-acid battery electrolyte.

2. Dispose of the lead-acid battery electrolyte at a permitted or interim status hazardous waste TSD facility.

The management and disposal if waste lead-acid batteries and

electrolyte shall comply with requirements for management and disposal of hazardous wastes.

F. Mercury Control: Prior to starting work, remove thermostats, switches, and other components that contain mercury. Upon removal, place items containing mercury in doubled polyethylene bags, label, and turn over to the Contracting Officer for disposal.

G. Petroleum Products: Protect against spills and evaporation during fueling and lubrication of equipment and motor vehicles. Dispose of lubricants to be discarded and excess oil.

3.9 DUST CONTROL

Keep dust down at all times, including nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not shake bags of cement, concrete mortar, or plaster unnecessarily.

A. Abrasive Blasting:

1. Blasting Operations: The use of silica sand is prohibited in sandblasting.

2. Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive, agent, paint chips, and other debris.

3. Disposal Requirements: Collect dust, sand, paint, and other debris resulting from abrasive blasting operations and store in 55-gallon drums with watertight lids. Take a representative sample of this material, and test for EP toxicity with respect to lead, chromium, and cadmium content. The sampling and testing shall be performed in accordance with 40 CFR 261. Handle debris resulting from the abrasive blasting operations as a hazardous material, and dispose of in accordance with 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Hazardous material shall be transported only by a transporter licensed and permitted for transportation of hazardous materials. Hazardous material shall be disposed of in an EPA-approved and permitted facility specifically designated for hazardous waste disposal. Dispose of non-hazardous abrasive blasting debris in accordance

with the paragraph entitled "Disposal of Rubbish and Debris."

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. EM 385-1-1 - U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

A. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

1.3 SUBMITTALS: Submit under provisions in Section 01300.

A. Work Plan: The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1.

1.4 DUST CONTROL

A. The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and

pollution.

1.5 PROTECTION

A. Protection of Personnel: During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, may be allowed to remain standing without additional bracing, shoring, of lateral support until demolished. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

B. Protection of Existing Property: Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

C. Protection From the Weather: The interior of buildings to remain and salvageable materials and equipment shall be protected from the weather at all times.

D. Protection of Trees: Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be protected by a 6 foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer

perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

E. Environmental Protection: The work shall comply with the requirements of Section 01570, TEMPORARY CONTROLS.

1.6 BURNING

A. The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

A. Use of explosives will not be permitted.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 EXISTING STRUCTURES

A. Interior walls, other than retaining walls and partitions, shall be removed to concrete slab. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

3.2 UTILITIES

A. Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

3.3 FILLING

A. Holes, open basements and other hazardous openings shall be filled in accordance with Section 02221.

3.4 DISPOSITION OF MATERIAL

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

A. Salvageable Items and Material: Contractor shall salvage items and material to the maximum extent possible.

B. Unsalvageable Material: Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in an approved disposal area located off site. Combustible material shall be disposed of off the site.

3.5 CLEAN UP

A. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION

SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. ASTM D 1556 - Density and Unit Weight of Soil in Place by the Sand-Cone Method.

B. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))

C. ASTM D 2167 - Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D. ASTM D 2216 - Laboratory Determination of Water (Moisture) Content of Soil, and Rock

E. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System)

F. ASTM D 2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

G. ASTM D 2937 - Density of Soil in Place by the Drive-Cylinder Method

H. ASTM D 3017 - Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

I. ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

A. Degree of Compaction: Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density.

1.3 SUBMITTALS: Submit under provisions of Section 01300.

A. Reports: Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

A. Satisfactory Materials: Satisfactory materials include materials classified in ASTM D 2487 as GW, GP, SW, GM, SM, and GC, SC, SP, and shall be free of trash, debris, roots or other organic matter, or stones larger than 3 inches in any dimension.

B. Unsatisfactory Materials: Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, ML, MH, CL, and CH and any other materials not defined as satisfactory.

C. Cohesionless and Cohesive Materials: Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

D. Expansive Soils: Expansive soils are defined as soils that have a plasticity index equal to or greater than 30 when tested in accordance with ASTM D 4318.

E. Nonfrost Susceptible (NFS) Material: Nonfrost susceptible material shall be a uniformly graded washed sand with a maximum particle size of 1/4 inch and less than 5 percent passing the No. 200 size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

2.2 CAPILLARY WATER BARRIER

A. Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 1-1/2 inches and no more than 2 percent by weight shall pass the No. 4 size sieve.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavation shall conform to the dimensions and elevations indicated on drawings. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. The naturally-occuring soil at the base of excavations shall be proof rolled to densify loose zones. This proof rolling shall consist of at least 4 passes of a 10-ton vibratory roller, or the equivalent effort. Should unstable areas become apparent, due to the presence of groundwater, the vibratory proofrolling shall be stopped and static methods be employed. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.2 DRAINAGE AND DEWATERING

A. Dewatering: Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 3 feet below the working level.

3.3 SHORING

A. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent

paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

3.4 CLASSIFICATION OF EXCAVATION

A. Excavation will be unclassified regardless of the nature of material encountered.

3.5 BLASTING

A. Blasting will not be permitted.

3.6 BORROW

A. Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained Section 02210 GRADING.

3.7 EXCAVATED MATERIALS

A. Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02210 GRADING.

3.8 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

A. Excavation to final grade shall not be made until just before concrete is to be placed. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond.

3.9 SUBGRADE PREPARATION

A. Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the

adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.10 FILLING AND BACKFILLING

A. Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 8 inches in loose thickness, or 6 inches when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors and underground fuel tanks. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and 1 foot above other utility lines shall be free from stones larger than 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
Fill, embankment, and backfill		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	95	95
Under sidewalks and grassed areas	85 90	
Nonfrost susceptible materials	95 95	
Subgrade		
Under building slabs, steps, and paved areas, top 12 inches	90	95
Under sidewalks, top 6 inches	85	90

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recompaction over underground utilities and heating lines shall be by hand tamping.

3.11 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft,

fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

A. In-Place Densities:

1. In-Place Density of Subgrades: One test per 5000 square foot or fraction thereof.

2. In-Place Density of Fills and Backfills: One test per 5000 square foot or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 5 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 500 square feet, or one test for each 50 linear foot of long narrow fills. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows: One check per lift for each 200 linear feet of long narrow fills, and a minimum of 1 checks per lift for other fill and backfill areas.

B. Moisture Content: In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

C. Optimum Moisture and Laboratory Maximum Density: Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.12 CAPILLARY WATER BARRIER

A. Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.13 PROTECTION

A. Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes.

END OF SECTION

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R	(1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4	(1995) Basic Hardboard

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1	(1996) Voluntary Product Standard - Construction and Industrial Plywood

1.2 NOT USED

1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA ANSI/AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Retain-In-Place Metal Forms

Retain-in-place metal forms for concrete slabs and roofs shall be as specified in Section 05300 STEEL DECKING.

2.1.5 NOT USED

2.1.6 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inchin diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

2.1.7 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1.	Variations from the plumb:	In any 10 feet of length ---------- 1/4 inch
	a. In the lines and surfaces of walls, and in arises	Maximum for entire length ---------- 1 inch
	b. For control-joint grooves, and other conspicuous lines	In any 20 feet of length ---------- ---- 1/4 inch Maximum for entire length---------- 1/2 inch
2.	Variation of distance between walls	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay,and not more than 1 inch total variation
3.	Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ---------- 1/4 inch Plus ---------- 1/2 inch
4.	Variation in thickness of slabs and walls	Minus ---------- 1/4 inch Plus ---------- 1/2 inch
5.	Footings:	
	a. Variation of dimensions in plan	Minus ---------- 1/2 inch Plus ---------- 2 inches when formed or plus 3 inches when placed against unformed excavation
	b. Misplacement of eccentricity	2 percent of the footing width in the direction of misplacement but not more than 2 inches

TABLE 1

TOLERANCES FOR FORMED SURFACES

c.	Reduction in thickness of specified thickness	Minus	5 percent
6.	Variation in steps:	Riser	1/8 inch
a.	In a flight of stairs	Tread	1/4 inch
b.	In consecutive steps	Riser	1/16 inch
		Tread	1/8 inch

-- End of Section --

SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4	(1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 919	(1984; R 1992) Use of Sealants in Acoustical Applications
ASTM C 920	(1995) Elastomeric Joint Sealants
ASTM D 471	(1996) Rubber Property - Effect of Liquids
ASTM D 1190	(1996) Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1191	(1984; R 1994) Test Methods for Concrete Joint Sealers
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1854	(1996) Specification for Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 1855	(1989) Test Method for Jet-Fuel Resistant Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 2628	(1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D 5249	(1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

CORPS OF ENGINEERS (COE)

COE CRD-C 513	(1974) Corps of Engineers Specifications

	for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Preformed Expansion Joint Filler; FIO. Sealant; GA. Waterstops; GA.

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops.

SD-06 Instructions

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

SD-13 Certificates

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA ANSI/AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751. Unless otherwise indicated, filler material shall be 1/2 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D 2628.

2.3.2 Lubricant for Preformed Compression Seals

ASTM D 2835.

2.3.3 Hot-Poured Type

ASTM D 1190 tested in accordance with ASTM D 1191.

2.3.4 Field Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.3.5 Hot-Applied Jet-Fuel Resistant Type

ASTM D 1854 tested in accordance with ASTM D 1855.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 NOT USED

2.4.2 NOT USED

2.4.3 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the

strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.1.3.1 Joints With Preformed Compression Seals

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

3.1.3.2 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and

completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 NOT USED

3.2.2 NOT USED

3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

3.2.3.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.3.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

-- End of Section --

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R	(1995) Building Code Requirements for Structural Concrete and Commentary

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 82	(1995a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	(1990a; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(1995b) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 767/A 767M	(1995) Zinc-Coated (Galvanized) Steel Bars in Concrete Reinforcement
ASTM A 775/A 775M	(1996) Epoxy-Coated Reinforcement Steel Bars
ASTM A 884/A 884M	(1996a) Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4	(1992) Structural Welding Code - Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1	(1996) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Concrete Reinforcement System; GA.

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-13 Certificates

Reinforcing Steel; FIO.

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 NOT USED

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767/A 767M or ASTM A 775/A 775M as appropriate.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A 884/A 884M.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4

inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet.

Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

-- End of Section --

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results
ACI 301	(1996) Standard Specifications for Structural Concrete
ACI 305R	(1991) Hot Weather Concreting
ACI 318/318R	(1995) Building Code Requirements for Reinforced Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991) Burlap Cloth Made From Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	(1991) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1993) Concrete Aggregates
ASTM C 39	(1994) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	(1994) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94	(1996) Ready-Mixed Concrete
ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete

ASTM C 150	(1995) Portland Cement
ASTM C 171	(1995) Sheet Materials for Curing Concrete
ASTM C 172	(1990) Sampling Freshly Mixed Concrete
ASTM C 173	(1994a) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete
ASTM C 309	(1995) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1995a) Blended Hydraulic Cements
ASTM C 940	(1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 989	(1994a) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017	(1992) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1064	(1986; R 1993) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1991a) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

CORPS OF ENGINEERS (COE)

COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA TMMB-01	(1992) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturers Bureau
NRMCA CPMB 100	(1990) Concrete Plant Standards
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

1.2 NOT USED

1.3 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Mixture Proportions; GA.

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-09 Reports

Testing and Inspection for Contractor Quality Control; GA.

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

1.5 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.6 NOT USED

1.7 NOT USED

1.8 GENERAL REQUIREMENTS

1.8.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.8.2 Strength Requirements and w/c Ratio

1.8.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
3000 psi at 28 days	All

Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39. Flexural strength shall be determined in accordance with ASTM C 78.

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests

of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.8.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
0.45	All

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.8.3 Air Entrainment

All normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 5000 psi may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.8.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

Structural Element	Slump Minimum	Slump Maximum
Foundation walls, substructure walls, footings, slabs	1 in.	3 in.

When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.

1.8.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

1.8.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.8.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.9 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.9.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in the paragraph Maximum Allowable w/c Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency

method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.9.2 NOT USED

1.9.3 NOT USED

1.9.4 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.9.4.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

f'cr = f'c + 1.34S where units are in psi

f'cr = f'c + 2.33S - 500 where units are in psi

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.9.4.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

a. If the specified compressive strength f'c is less than 3,000 psi,

f'cr = f'c + 1000 psi

b. If the specified compressive strength f'c is 3,000 to 5,000 psi,

f'cr = f'c + 1,200 psi

c. If the specified compressive strength f'c is over 5,000 psi,

f'cr = f'c + 1,400 psi

1.10 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.11 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.11.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of

batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.11.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.11.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.11.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, portland blast-furnace slag cement, or portland cement in combination with or ground granulated blast furnace slag and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I with a maximum 15 percent amount of tricalcium aluminate, or Type II.

2.1.2 NOT USED

2.1.3 Blended Cements

ASTM C 595, Type IS.

2.1.4 NOT USED

2.1.5 Ground Granulated Blast-Furnace (GGBF) Slag

ASTM C 989, Grade 120.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation 67.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, Grade C, and shall be a commercial formulation suitable for the proposed application.

2.7 NOT USED

2.8 NOT USED

2.9 NOT USED

2.10 NOT USED

2.11 NOT USED

2.12 NOT USED

2.13 NOT USED

2.14 JOINT MATERIALS

2.14.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751. Materials for waterstops shall be in accordance with Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

2.14.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock

surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02315EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.2 NOT USED

3.3 CONCRETE PRODUCTION, SMALL PROJECTS

Batch-type equipment shall be used for producing concrete. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB-01. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall be produced in accordance with ACI 301, and plant shall conform to NRMCA CPMB 100.

3.4 NOT USED

3.5 NOT USED

3.6 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers, agitators, nonagitating transporting equipment conforming to NRMCA TMMB-01 or by approved pumping equipment or conveyors.

3.7 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.7.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet.The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yardsshall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.7.2 NOT USED

3.7.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for

transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.7.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.7.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper , for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches. The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.7.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.8 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.8.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer.

Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.8.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segration or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.8.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.8.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the

day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

3.8.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.9 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07900 JOINT SEALING.

3.9.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 20 feet. Concrete

shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inchsquare-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.9.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by sawing a continuous slot with a concrete saw. The slot shall be 1/4 the depth of the slab thickness and between 1/8 and 3/16 inch wide. Cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.9.3 NOT USED

3.9.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.9.5 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.10 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by

use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.10.1 Class A Finish and Class B Finish

Class B finish is required in the following areas, exterior stair. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.10.2 Class C and Class D Finish

Class C finish is required in the following areas, elevator pit. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.11 REPAIRS

3.11.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inchesshall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.11.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class A and B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.11.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inchesshall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.11.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete

containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

3.12 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.12.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.12.2 NOT USED

3.12.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The following areas elevator pit slab, elevator shaft roof slab, and chiller pad shall be given only a float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.12.4 Troweled Finish

Areas as indicated on the drawings. The following areas mezzanine floor slabs shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, by hand until the surface has been troweled 2 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.12.5 NOT USED

3.12.6 NOT USED

3.12.6.1 Broomed

The following areas exterior stair shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.13 NOT USED

3.14 NOT USED

3.15 CURING AND PROTECTION

3.15.1 General

Concrete shall be cured by an approved method for the period of time given below:

All concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Except for plastic coated burlap, impervious sheeting alone shall not be

used for curing.

3.15.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.15.3 Membrane Forming Curing Compounds

Membrane forming curing compounds shall be used only on exterior surfaces areas. Concrete in these may be cured with a pigmented curing compound in lieu of moist curing. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.15.4 Impervious Sheeting

Interior concrete surfaces may be cured using impervious sheets. However, except for plastic coated burlap, impervious sheeting alone shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet

shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

3.15.5 NOT USED

3.15.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Government, as required, and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.16 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

3.16.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.16.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.16.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be

maintained at 65 to 85 degrees F until after setting.

3.16.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.17 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077.

3.17.1 Grading and Corrective Action

3.17.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.17.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.17.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall

perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.17.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.17.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.17.5 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173 for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0

percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or

lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.

e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064. The temperature shall be reported along with the compressive strength data.

f. Strength Specimens. At least one set of test specimens shall be made, for compressive strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39 for test cylinders. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.17.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.17.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.17.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.17.9 Curing Inspection

a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.

c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.

d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.17.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.17.11 Mixer Uniformity

a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.

b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.17.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

SECTION 03530

SELF-LEVELING CONCRETE FLOOR UNDERLAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self-leveling cementitious floor underlayment.

B. Manufacturer approved primer.

1.2 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Data: Submit manufacturers descriptive catalog literature containing information verifying products comply with these specifications.

B. Certificates:

1. Installer’s Certificate
2. Warranty

1.3 REFERENCES

A. ASTM C 109
B. ASTM C 190
C. ASTM C 348

1.4 QUALITY ASSURANCE

A. Installer’s Qualifications: Installation of self-leveling concrete floor underlayment shall be by an applicator authorized by the manufacturer using approved mixing and pumping equipment.

1.5 QUALIFICATIONS

A. Installer: Installer specializing in the installation of the product specified in this section with a minimum of 4 years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. General Requirements: Materials shall be delivered in their original, unopened packages, and protected from exposure to the elements. Damaged or deteriorated materials shall be removed from the premises.

1.7 SITE CONDITIONS

A. Environmental Requirements: Before, during and after

installation of self-leveling concrete, building interior shall be enclosed and maintained at a temperature above 40 deg. F (4.4 deg. C) and below 100 deg. F (37.7 deg. C) until structure and subfloor temperature are stabilized.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cementitious Self-Leveling Poured Floor Underlayment: Floor underlayment shall be potable water based topping compound with a compressive strength of 7000 psi in 28 days, dry density of approx. 120-125 lbs/ft^3, tensile strength of 810 psi, and flexural strength of 1250 psi.

2.2 MIX DESIGNS

A. General Requirements: Self-leveling concrete proportions and methods shall be in strict accordance with product manufacturer recommendations.

PART 3 EXECUTION

3.1 PREPARATION

A. Condition and Cleaning of Concrete: Concrete shall be structurally sound, concrete sealed. General Contractor shall clean concrete to remove mud, oil, grease, and other contaminating factors before arrival of the self-leveling concrete underlayment crew.

B. Leak prevention: Fill cracks and voids with a quick setting patching or caulking material where leakage of self-leveling concrete could occur.

C. Priming Concrete: Prime concrete using the Manufacturer Approved Primer. Priming instructions vary according to the porosity of the concrete, multiple coats may be necessary.

D. Expansion Joints: Allow joints to continue through the self-leveling concrete at the same width.

3.2 APPLICATION OF SELF-LEVELING FLOORING

A. Scheduling: Application of self-leveling concrete shall not begin until the building is enclosed, including roof, windows, doors, and other fenestration. Install after drywall installation unless tenant finish requirements identify partitioning after the pour.

B. Application: Place self-leveling concrete 0-1 ½" (0-38 mm). Deeper application can be done in multiple lifts. Spread and float to a smooth surface. Except at authorized joints, place as continuously as possible until application is complete so that no slurry is placed against self-leveling concrete product that has obtained its initial set.

C. Drying: General Contractor shall provide continuous ventilation and adequate heat until self-leveling concrete is dry. General Contractor shall provide mechanical ventilation if necessary.

3.3 PREPARATION FOR INSTALLATION OF GLUE DOWN FLOOR GOODS

A. Check for Dryness: Check for dryness using hte recommended procedure of taping a 24" x 24" (609 mm x 609 mm) sections of plastic to the surface of hte underlayment; or lay flat, 24" x 24" (609 mm x 609 mm), high-density, smooth rubber mat weighted down on the underlayment surface. If no condensation or darkening of the slab occurs in 48 to 72 hours, the underlayment is considered dry and ready for the following steps. Perform additional tests if necessary.

B. Applying Overspray: Porosity of the floor is a prime factor in the drying rate of adhesives. This porosity factor may reduce the effective adhesive open time. An application of manufacturer overspray will minimize the porosity factor.

Before priming, test the underlayment for dryness. The underlayment must be fully dry before priming.

After diluting per the above rate, spray or roll the overspray at a rate of 300 sq. ft. (27.87 m^2) per gallon of mix.

Make certain surface to receive the overspray is free of mud, oil, grease and other contaminants. For maximum results, the overspray is applied about 1-2 hours prior to adhesive application. Latex adhesives will not achieve maximum bond until moisture has dissipated.

C. Acrylic Sealer: After Step 1 is completed, dilute acrylic sealer or overspray 4:1 by adding 4 gallons (15.1L) of water to 1 gallon (3.8 L) of acrylic sealer or overspray. Spray or roll this dilution at a rate of 200 sq. ft. (18.58 m^2) per gallon of mix.

3.4 FIELD QUALITY CONTROL

A. Field Samples: At least one set of 3 molded cube samples shall be taken as recommended by the Manufacturer in accordance with modified ASTM C 109. Test results shall be available to architect and/or contractor upon request from applicator.

3.5 PROTECTION

A. Protection From Heavy Loads: During construction, place temporary wood planking over underlayment wherever it will be subject to heavy wheeled or concentrated loads.

END OF SECTION

SECTION 04100

MORTAR AND MASONRY SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mortar and grout for masonry.

B. Pre-bagged prepared mortar mix is not acceptable.

1.2 RELATED SECTIONS

A. Section 04311 - Concrete Masonry Units: Installation of mortar and grout.

B. Section 04320 - Veneer Masonry System: Installation of mortar.

C. Section 04340 - Reinforced Unit Masonry System: Installation of mortar and grout.

D. Section 08112 - Standard Steel Frames: Grouting steel door frames.

1.3 REFERENCES

A. ACI 530 - Building Code Requirements for Masonry Structures.

B. ACI 530.1 - Specifications For Masonry Structures.

C. ASTM C5 - Quicklime for Structural Purposes.

D. ASTM C94 - Ready-Mixed Concrete.

E. ASTM C144 - Aggregate for Masonry Mortar.

F. ASTM C150 - Portland Cement.

G. ASTM C207 - Hydrated Lime for Masonry Purposes.

H. ASTM C270 - Mortar for Unit Masonry.

I. ASTM C404 - Aggregates for Masonry Grout.

J. ASTM C476 - Grout for Masonry.

K. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

L. ASTM C1019 - Method of Sampling and Testing Grout.

M. ASTM C1072 - Method for Measurement of Masonry Flexural Bond Strength.

N. ASTM E447 - Test Methods for Compressive Strength of Masonry Prisms.

O. ASTM E518 - Test Method for Flexural Bond Strength of Masonry.

P. IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Design Mix: indicate whether the Proportion or Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

B. Samples: Submit two samples of mortar, illustrating mortar color and color range.

C. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270.

D. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to ASTM C1019.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes.

C. Store cementitious materials off the ground, under cover, and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 MATERIALS

A. Portland Cement: ASTM C150, Type I, gray color.

B. Mortar Aggregate: ASTM C144, standard masonry type.

C. Hydrated Lime: ASTM C207, Type S.

D. Grout Course Aggregate: ASTM C404.

E. Water: Clean and potable.

F. Bonding Agent: Latex

2.3 MORTAR COLOR

A. Mortar Color: Mineral oxide pigment; gray color to match existing.

2.4 MORTAR MIXES

A. Mortar For Load Bearing Walls and Partitions: ASTM C270, Type M using the Property specification.

B. Mortar For Non-Load Bearing Walls and Partitions: ASTM C270, Type S using the Property specification.

C. Mortar For Engineered Masonry: ASTM C270, Type M using the Property specification.

D. Pointing Mortar: ASTM C270, Type N using the Property specification.

2.5 MORTAR MIXING

A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

F. Use mortar within two hours after mixing at temperatures of 90 degrees F (32 degrees C), or two-and-one-half hours at temperatures under 40 degrees F.

2.6 GROUT MIXES

A. Bond Beams and Lintels: 2,500 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 Course grout.

B. Engineered Masonry: 2,500 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 Course grout.

2.7 GROUT MIXING

A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 Course grout.

B. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

C. Do not use anti-freeze compounds to lower the freezing point of grout.

2.8 MIX TESTS

A. Test mortar and grout in accordance with Section 01440.

B. Testing of Mortar Mix: In accordance with ASTM C270.

C. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and slump.

PART 3 EXECUTION

3.1 EXAMINATION

A. Request inspection of spaces to be grouted.

3.2 INSTALLATION

A. Install mortar and grout to requirements of the specific masonry sections. Use masonry "grout" in only walls constructed of masonry.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not install grout in lifts greater than 16 inches two CMU courses without consolidating grout by rodding.

D. Do not displace reinforcement while placing grout.

E. Remove excess mortar from grout spaces.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01440.

B. Test and evaluate mortar in accordance with ASTM C780.

C. Test and evaluate grout in accordance with ASTM C1019.

D. Test mortar and masonry units to ASTM E447; test in conjunction with masonry unit sections specified.

END OF SECTION

SECTION 04311

CONCRETE MASONRY SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete masonry units.

B. Flashing.

C. Reinforcement, anchorage, and accessories.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 05500 - Metal Fabrications: Placement of fabricated steel items.

1.3 RELATED SECTIONS

A. Section 04100 - Mortar and Masonry Grout: Mortar and grout.

B. Section 07160 - Bituminous Dampproofing: Dampproofing masonry surfaces.

C. Section 07212 - Board Insulation.

D. Section 07620 - Sheet Metal Flashing and Trim: Cap flashings over masonry work.

E. Section 07900 - Joint Sealers: Rod and sealant at control joints.

1.4 REFERENCES

A. ACI 530 - Building Code Requirements for Masonry Structures.

B. ACI 530.1 - Specifications For Masonry Structures.

C. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.

D. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.

E. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.

F. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

G. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

H. ASTM B370 - Copper Sheet and Strip for Building Construction.

I. ASTM C34 - Structural Clay Load-Bearing Wall Tile.

J. ASTM C55 - Concrete Building Brick.

K. ASTM C56 - Structural Clay Non-Load Bearing Tile.

L. ASTM C90 - Load-Bearing Concrete Masonry Units.

M. ASTM C129 - Non-Load Bearing Concrete Masonry Units.

N. ASTM C212 - Structural Clay Facing Tile.

O. ASTM C216 - Facing Brick (Solid Masonry Units Made From Clay or Shale).

P. ASTM C530 - Structural Clay Non-Load Bearing Screen Tile.

Q. ASTM C652 - Hollow Brick (Hollow Masonry Units Made From Clay or Shale).

R. ASTM C744 - Pre-faced Concrete and Calcium Silicate Masonry Units.

S. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

T. UL - Fire Resistance Directory.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to UBC code for masonry construction.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

C. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

1.11 COORDINATION

A. Coordinate the masonry work with installation of window anchors.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Hollow Load Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled normal weight.

B. Hollow Non-Load Bearing Block Units (CMU): ASTM C129, Type I - Moisture Controlled; normal weight.

C. Size and Shape: Nominal modular size of 8 x 8 x 16 inches. Provide special units for 90 degree corners, bond beams, lintels.

D. Pre-Faced Block Units: ASTM C744 with resinous surfacing on ASTM C90 Masonry Units, Type I - Moisture Controlled; normal weight; color as selected.

2.2 REINFORCEMENT AND ANCHORAGE

A. Single Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication, 3/16 inch side rods with 9 US gauge cross ties.

1. Manufacturers:

   a. Heckman Building Products, Inc.
   b. Dur-O-Wal, Inc.
   c. Hohman & Barnard, Inc.

B. Rigid Partition Anchors: bent steel shape, 1 1/2 inch wide x 1/8 inch thick, length as shown, hot dip galvanized to ASTM A123 B2 finish.

1. Manufacturers:

   a. Heckman Building Products, Inc. Model A0
   b. Dur-O-Wal, Inc. Model D/A301Z
   c. Hohman & Barnard, Inc. Model No. 344

C. Column Anchors: wire tie welded to 5/16 x 5 inch x 12 gage thick, adjustable, hot dip galvanized to ASTM A123 B2 uncoated steel finish.

1. Manufacturers:

   a. Heckman Building Products, Inc. Model 315-C & 318-B
   b. Dur-O-Wal, Inc. Model D/A 207 & D/A 750
   c. Hohman & Barnard, Inc. Model #359F & 302W

2.3 MORTAR AND GROUT

A. Mortar and Grout: As specified in Section 04100.

2.4 FLASHINGS

A. Copper: ASTM B370, cold rolled; 20 oz/sq ft, 0.027 inch thick; natural finish.

B. Lap Sealant: Butyl type as specified in Section 07900.

2.5 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, heat fused joints.

1. Manufacturers:
   a. Heckman Building Products, Inc.
   b. Dur-O-Wall
   c. Hohmann & Barnard, Inc.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self-expanding.

1. Manufacturers:

a. Heckman Building Products, Inc.
b. Dur-O-Wal
c. Hohmann & Barnard, Inc.

C. Building Paper: No. 15 asphalt saturated felt.

D. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

E. Weeps: Preformed plastic tubes.

1. Manufacturers:

a. Heckman Building Products, Inc.
b. Dur-O-Wall
c. Hohmann & Barnard, Inc.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other Sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.4 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

C. Remove excess mortar as work progresses.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, or bitumen dampproofing is applied.

H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.5 WEEPS

A. Install weeps at 16 inches oc horizontally above through-wall flashing, above shelf angles, at bottom of walls.

3.6 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce joint corners and intersections with strap anchors 16 inches oc.

3.7 MASONRY FLASHINGS

A. Extend flashings horizontally at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls.

B. Turn flashing up minimum 8 inches and bed into mortar joint of masonry seal to concrete seal to sheathing over wood steel stud framed back-up.

C. Lap end joints minimum 6 inches and seal watertight.

D. Turn flashing, fold, and seal at corners, bends, and interruptions.

3.8 LINTELS

A. Install steel lintels as scheduled.

B. Install reinforced unit masonry lintels over openings where precast concrete lintels are not scheduled.

C. Openings Up To 42 inches Wide: Place two, No. 3 reinforcing bars 1 inch from bottom web.

D. Openings From 42 inches Up To 78 inches Wide: Place two, No. 5 reinforcing bars 1 inch from bottom web.

E. Openings Over 78 inches: Reinforce openings as detailed.

F. Do not splice reinforcing bars.

G. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

H. Place and consolidate grout fill without displacing reinforcing.

I. Allow masonry lintels to attain specified strength before removing temporary supports.

J. Maintain minimum 8 inch bearing on each side of opening.

3.9 GROUTED COMPONENTS

A. Reinforce bond beam with 2, No. 5 bars, 1 inch from bottom web.

B. Reinforce pilaster as indicated.

C. Lap splices minimum 24 bar diameters.

D. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

E. Place and consolidate grout fill without displacing reinforcing.

F. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.10 CONTROL JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joint in accordance with Section 07900 for sealant performance.

3.11 BUILT-IN WORK

A. As work progresses, install built-in metal door and frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.

B. Install built-in items plumb and level.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build in organic materials subject to deterioration.

3.12 TOLERANCES

A. Maximum Variation From Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.13 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.15 PROTECTION OF FINISHED WORK

A. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

SECTION 04320

VENEER MASONRY SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Facebrick units.

B. Reinforcement, anchorage, and accessories.

C. Stone masonry veneer anchored to unit masonry back-up.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 05120 - Structural Steel: Placement of steel anchors for brick veneer reinforcement, including loose steel lintels, fabricated steel items, and steel angles.

B. Section 08520 - Aluminum Windows: Placement of window anchors in brick veneer.

1.3 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Structural wall backing.

B. Section 04100 - Mortar and Masonry Grout: Mortar and grout.

C. Section 07620 - Sheet Metal Flashing and Trim: Cap flashings over masonry work and placement of reglets for flashings.

D. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.

E. Section 04311 - Concrete Masonry Units: Insulation, concealed flashing, horizontal joint reinforcement, anchors, and ties installed in both unit masonry and stone masonry veneer.

1.4 REFERENCES

A. ACI 530 - Building Code Requirements for Masonry Structures.

B. ACI 530.1 - Specifications For Masonry Structures.

C. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.

D. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

E. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.

F. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

G. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

H. ASTM B370 - Copper Sheet and Strip for Building Construction.

I. ASTM C55 - Concrete Building Brick.

J. ASTM C90 - Load-Bearing Concrete Masonry Units.

K. ASTM C216 - Facing Brick (Solid Masonry Units Made From Clay or Shale).

L. ASTM C652 - Hollow Brick (Hollow Masonry Units Made From Clay or Shale).

M. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

N. UL - Fire Resistance Directory.

1.5 SUBMITTALS: Submit under provisions of Division 1.

A. Product Data: Provide data for veneer masonry units and fabricated wire reinforcement.

B. Samples: Submit four samples each of face brick units to illustrate color, texture and extremes of color range. Final approval of color and texture for brick will be granted from on site inspection.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

D. Shop Drawings: Indicate sizes, spacing, locations, attachments and anchorage for granite.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable UL Design Assemblies, as indicated for fire rated masonry construction.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in a undamaged condition and stored out of contact with the ground in a manner to avoid chipping and breakage.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

1.12 COORDINATION

A. Coordinate the masonry work with brick veneer, and installation of window anchors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. BRICK UNITS

1. Belden Brick.

2. Glen-Gery.

3. US Brick.

2.2 MASONRY UNITS

A. Brick Units

1. Face Brick: ASTM C216, Type FBS, Grade SW; color to match existing.
2. Hollow Facing and Building Brick: ASTM C652, Grade SW, Type HBS; color to match existing.
3. Size and Shape: Nominal modular size of 3-5/8 x 2-1/4 x 7-5/8 inches. Provide special units for 90 degree corners, and lintels.

2.3 REINFORCEMENT AND ANCHORAGE

A. See Section 04311 - Concrete Masonry Unit for reinforcement and anchorage requirements of seismic and non-seismic conditions.

2.4 MORTAR AND GROUT

A. Mortar and Grout: As specified in Section 04100.

2.5 FLASHINGS

A. Flashing: as specified in Section 04311 and 04320.

2.6 ACCESSORIES

A. Preformed Control Joints: Closed cell neoprene sponge material. Provide with corner and tee accessories, heat fused joints.

1. Manufacturers:

a. Dur-O-Wall
b. Hohmann & Barnard, Inc.

B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self-expanding; 3/4 inch wide x by maximum lengths.

C. Filter Fabric:

1. PEC-MAT as manufactured by Greenstreak, Inc., 3400 Tree Court Ind. Blvd., St. Louis, MO
2. MIRMAT - Series 2400 as manufactured by Mirafi, Inc., Charlotte, N.C.

D. Weeps: Preformed plastic tubes.

1. Manufacturers:

a. Dur-O-Wal
b. Hohmann & Barnard, Inc.
c. Heckman Industries, Inc.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Brick Units:
1. Bond: Running.
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

D. Stone Units:
1. Bond & couplings as shown on the drawings.
2. Mortar Joints: Concave.

3.4 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

D. Remove excess mortar as Work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Isolate top joint of masonry walls from horizontal structural framing members and slabs or decks with compressible joint filler.

3.5 WEEPS

A. Install weeps in veneer at 24 inches (600 mm) oc horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls.

3.6 CAVITY BEHIND VENEER

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps.

B. Build outer wythe to permit installation of cavity insulation.

3.7 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches oc.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Embed wall ties in masonry back-up for bonding veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place at maximum 3 inches oc each way around perimeter of openings, within 12 inches of openings.

3.8 MASONRY FLASHINGS

A. Extend flashings horizontally at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls.

B. Turn flashing up minimum 8 inches and bed into mortar joint of masonry seal to concrete back-up.

C. Lap end joints minimum 6 inches and seal watertight.

D. Turn flashing, fold, and seal at corners, bends, and interruptions.

3.9 LINTELS

A. Install loose steel lintels over openings.

B. Maintain minimum 8 inch bearing on each side of opening.

3.10 CONTROL JOINTS

A. Do not continue horizontal joint reinforcement through control joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joint in accordance with Section 07900 for sealant performance.

3.11 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

3.12 CUTTING AND FITTING

A. Cut and fit for conduit, sleeves, and recessed items. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 CLEANING

A. Remove excess mortar and mortar smears.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.14 PROTECTION OF FINISHED WORK

A. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

SECTION 04340

REINFORCED UNIT MASONRY SYSTEM

This section includes engineered, steel reinforced, structural and/or load bearing masonry, usually with high slump grout or concrete filled cores, cavities, and horizontal bond beams and lintels.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete masonry units.

B. Joint reinforcement, anchorage, and accessories.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 05120 - Structural Steel: Special anchors for attachment to structural steel.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 05500 - Metal Fabrications: Placement of loose steel lintels, fabricated steel items.

B. Section 07620 - Flashing and Sheet Metal: Placement of reglets for flashings.

1.4 RELATED SECTIONS

A. Section 01440 - Contractor Quality Control.

B. Section 04100 - Mortar and Masonry Grout: Mortar and grout.

C. Section 05500 - Metal Fabrications: Loose steel lintels and fabricated steel items.

D. Section 07160 - Bituminous Dampproofing: Dampproofing masonry surfaces.

E. Section 07620 - Sheet Metal Flashing and Trim: Cap flashings over masonry work and placement of reglets for flashings.

F. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.

1.5 REFERENCES

A. ACI SP-66-1988 ACI Detailing Manual

B. ACI 530-88/ASCE 5-88 - Building Code Requirements for Masonry Structures.

C. ACI 530.1-88/ASCE 6-88 - Specifications For Masonry Structures (including Specified References, Para. 1.3.)

D. ASTM A82-90a - Cold-Drawn Steel Wire for Concrete Reinforcement.

E. ASTM A167-86 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.

F. ASTM A525-83 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

G. ASTM A615-86 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

H. ASTM C55-85 - Concrete Building Brick.

I. ASTM C90-90 - Load-Bearing Concrete Masonry Units.

J. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

K. UL - Fire Resistance Directory.

1.6 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate bars sizes, spacings, locations, reinforcement quantities, bending and cutting schedules, supporting and spacing devices for reinforcement, accessories.

B. Product Data: Provide data for masonry units and fabricated wire reinforcement.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with applicable provisions in ACI 530 and ACI 530.1.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to UBC code for masonry construction.

1.10 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this section.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site in undamaged condition.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

1.13 COORDINATION

A. Coordinate the masonry work with masonry veneer and installation of window and door anchors.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS (See Section 04311)

2.2 REINFORCEMENT AND ANCHORAGE

A. Single Wythe Joint Reinforcement: (See Section 04311)

B. Reinforcing Steel: ASTM A615 type.

C. Strap Anchors: Bent steel shape, 1 1/2 inch wide x 1/8 inch thick, hot dip galvanized to ASTM A525 Class G60 (1.50 oz./ft^2 finish.

2.3 MORTAR AND GROUT

A. Mortar and Grout: As specified in Section 04100.

2.4 ACCESSORIES (See Section 04311)

PART 3 EXECUTION (See Section 04311 except as follows)

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

D. Remove excess mortar as Work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, or bitumen dampproofing is applied.

I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

K. The tops of all masonry walls shall be covered at end of each workday to prevent the accumulation of moisture in cavities.

3.3 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches oc.

B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

F. Embed anchors embedded in concrete or attached to structural steel members. Embed anchorages in every second block joint.

G. Reinforce joint corners and intersections with strap anchors 16 inches oc.

3.4 GROUTED COMPONENTS

A. Reinforce bond beam, pilasters and CMU cells, and grout as shown on drawings.

B. Lap splices minimum 24 bar diameters.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.5 ENGINEERED MASONRY

A. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.

B. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 7 days before placing grout.

C. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated.

D. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters.

E. Wet masonry unit surfaces in contact with grout just prior to grout placement.

F. Grout spaces less than 2 inches in width with Fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with Course grout using high or low lift grouting techniques.

G. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.

H. Grouting: (conform to ACI 530.1/ASCE 6-88 Section 4)

END OF SECTION

SECTION 04900

RESTORATION AND CLEANING OF MASONRY IN HISTORIC STRUCTURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI Compilation 20	(1992) Repair and Rehabilitation II

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGENISTS (ACGIH)

ACGIH-02	(1996) Threshold Limit Values for Chemical Substances and Physical Agents Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1996) Carbon Structural Steel
ASTM C 109	(1995) Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
ASTM C 150	(1996) Portland Cement
ASTM C 207	(1991; R 1992) Hydrated Lime for Masonry Purposes
ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 1324	(1996) Examination and Analysis of Hardened Masonry Mortar
ASTM D 3399	(1981; R 1995) General-Purpose Synthetic Detergent Liquid

BRICK INSTITUTE OF AMERICA (BIA)

BIA Tech Note 20 Rev II	(1990) Cleaning Brick Masonry

1.2 GENERAL REQUIREMENTS

Work shall be done in conformance with ACI Compilation 20. Non-historic masonry work, including materials, procedures, and requirements shall conform to Section 04200 MASONRY, except as otherwise specified herein.

1.2.1 Cleaning and Restoration Methods

The cleaning and restoration methods, and materials selected for a specific structure, shall be submitted for approval before work starts, and shall take into account the total construction system of the building to be worked upon, including different masonry and mortar materials, as well as non-masonry elements which may be affected by the work.

1.2.2 Ionic Cleaners

Ionic chemical cleaners shall be used as specified, in accordance with the manufacturer's instructions, and only upon the direction of the Contracting Officer. Ionic cleaners shall be used only after gentler cleaning methods have been determined to be ineffective through the use of test panels.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Cleaning and Restoration Methods; GA.

Descriptive narrative in cleaning and repair methods to be employed in the work. Description shall be organized in sequence from preparation through completion of the work. Schedule showing estimated time, in calendar days, for completion of each phase of the work shall be included.

Qualifications; GA.

Documentation showing Contractor's experience of 5 consecutive years in masonry restoration, plus a list of similar jobs to the one specified herein.

SD-04 Drawings

Masonry; FIO.

Drawings showing location of masonry elements in the work, building elevations, interface with adjacent materials, and special placing instructions, in sufficient detail to cover fabrication, placement, and finishing.

SD-13 Certificates

Materials; GA.

Certificates of compliance attesting that the materials, equipment, and cleaning agents (chemicals, detergents, etc.) to be used in the work meet the specified requirements.

SD-14 Samples

Materials; GA.

Samples of the materials listed below; indicating sizes, shapes, finishes, color, and pertinent accessories: [_____].

1.4 QUALIFICATIONS

The Contractor shall provide qualified workers, trained and experienced in restoration of masonry in historic structures, and shall furnish documentation of 5 consecutive years of work of this type. A list of similar jobs shall be provided identifying when, where, and for whom the work was done.

1.5 EQUIPMENT AND TECHNIQUES DEMONSTRATION

Equipment and techniques of operation shall be demonstrated in an approved location and shall be subject to approval. Dependable and sufficient

equipment, appropriate and adequate to accomplish the work specified, shall be assembled at the work site in sufficient lead time before the start of the work to permit inspection, calibration of weighing and measuring devices, adjustment of parts, and the making of any repairs that may be required. The equipment shall be maintained in good working condition throughout the project.

1.5.1 Cleaning Equipment

Cleaning equipment shall not cause staining, erosion, marring, or other damage or changes in the appearance of the surfaces to be cleaned.

1.5.1.1 Sandblasting

Sandblasting equipment will not be allowed for cleaning masonry surfaces.

1.5.1.2 Water Blasting

Water blasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water re-supply equipment. The equipment shall not be operated at a pressure which will cause etching or other damage to the masonry surface or mortar joints. The equipment shall be operated at a discharge capacity of 55 to 500 psi and 2.5 to 3 gpm for general surface cleaning operations. The water tank and auxiliary re-supply equipment shall be of sufficient capacity to permit continuous operations. The Contractor shall provide protective covers and barriers as required to prevent over-spray onto adjacent surfaces.

1.5.2 Drilling Equipment

Equipment used to drill holes in masonry, for patch anchors and other applications, shall be standard handheld masonry drills, commonly used for drilling small holes in concrete and masonry. The drill shall be a small, powered, handheld type, using rotary drilling mode only. Impact and rotary impact type drills will not be allowed.

1.5.3 Finishing and Texturing Equipment

Equipment and hand tools used for placing, finishing and texturing masonry and mortar shall be commercially available and commonly used in masonry construction and repair. Surface grinders, impact tools, and other equipment shall conform to the specified requirements, except as specifically required by the type of finish and texture.

1.5.4 Compressed Air Supplies

Compressed air equipment shall deliver clean, oil and moisture free compressed air at the surface to be cleaned. The compressed air line shall have at least two in-line air filters to remove oil and moisture from the air supply. The compressed air supply shall be tested during each shift for the presence of oil and moisture.

1.5.5 Material Handling and Associated Equipment

1.5.5.1 Mixing, Transporting, and Placing Job Materials

Equipment used for mixing, transporting, placing, and confining masonry and mortar placements shall be capable of satisfactorily mixing material and supporting placement operations in an uninterrupted manner. Defects and deficiencies in operation or capacity shall be resolved prior to use in the work. Equipment used for mixing, conveying, and placing of materials shall be clean, free of old materials and contaminants, and shall conform to the material manufacturer's recommendations.

1.5.5.2 Associated Equipment

Associated equipment such as mixer timing equipment, valves, pressure gauges, pressure hoses, other hardware, and tools shall be provided as required to ensure a continuous supply of material and operation control.

1.6 SAMPLE MASONRY PANELS

Sample panels of each procedure proposed for use in the work shall be submitted for approval. No masonry or mortar shall be used in the work until the samples and the represented mixture have been approved.

1.7 MATERIAL REQUIREMENTS

1.7.1 Strength

Each class or mixture of mortar shall have a 28-day compressive strength matching the compressive strength of the original existing mortar in the structure as determined by ASTM C 109 for mortar. Test specimens of existing mortar shall be taken from a sound and intact representative portion of the structure, at locations indicated.

1.7.2 Special Properties

Mortar may contain admixtures, such as pigments, to match the characteristics of the original mortar. Use of all admixtures shall be subject to approval.

1.7.3 Cementitious Content of Mortar

Each class or mixture of mortar shall have a cement content matching the cement content of the original existing mortar in order to provide uniform strength, weathering characteristics, and appearance of repaired surfaces in relation to existing surfaces.

1.8 STORAGE OF MATERIALS

Materials shall be stored in weathertight structures which will exclude moisture and contaminants. Cement shall be furnished in suitable bags used for packaging cements. Labeling of packages shall clearly define contents, manufacturer, and batch identification. Detergents, masonry cleaners, paint removers, solvents, epoxies and other chemicals used for masonry cleaning shall be in sealed containers that legibly show the designated name, formula or specification number, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Accessories shall be stored avoiding contamination and deterioration. Admixtures which have been in storage onsite for six months or longer, or which have been subjected to freezing, shall not be used unless retested and proven to meet the specified requirements.

1.9 SAFETY AND HEALTH

Work shall comply with applicable federal, state, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis, specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of cleaning operations on personnel and on others involved in and adjacent to the work zone.

1.9.1 Worker Exposures

Exposure of workers to chemical substances shall not exceed the limits established by ACGIH-02, or those required by a more stringent applicable regulation.

1.9.2 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material safety data sheets, of potential health and safety hazard, and of protective controls associated with materials used on the project. An affected work area is one which may receive dust, mists, and odors from the surface preparation operations. Workers involved in masonry cleaning shall be trained in the safe handling and application, and the exposure limit, of each material to be used in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.9.3 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from surface preparation, cleaning, and repair operations.

1.10 PROTECTION

Persons, motor vehicles, adjacent surfaces, surrounding buildings, equipment, and landscape materials shall be protected from chemicals used and runoff from cleaning and paint removal operations. Temporary protection covers, which shall remain in operation during the course of the work, shall be erected over pedestrian walkways and at personnel and vehicular points of entrance and exit.

1.10.1 Interior Protection

The interior of buildings shall be protected from the weather, cleaning, and repair operations at all times.

1.10.2 Environmental Protection

The work shall comply with the requirements of Sections 01410ENVIRONMENT PROTECTION.

1.11 WEATHER LIMITATIONS

Masonry, mortar, and epoxy adhesives shall not be placed when weather conditions detrimentally affect the quality of the finished product. No masonry or mortar shall be placed when the air temperature is below 40 degrees F in the shade. When air temperature is likely to exceed 90 degrees F masonry and mortar shall have a temperature not exceeding 90 degrees F when deposited. Materials to be used in the work shall be neither produced nor placed during periods of rain or other precipitation. Material placements shall be stopped, and all in-place material shall be protected from exposure, during periods of rain or other precipitation.

1.12 WARRANTIES

1.12.1 Cleaning Warranty

Cleaning procedures shall be warranted for a period of two years against harm to substrate (masonry and mortar) or to adjacent materials including, but not limited to, discoloration of substrate from improper procedures or usage, chemical damage from inadequate rinse procedures, and abrasive damage from improper procedures.

1.12.2 Repair Warranty

Repair procedures, including repointing, shall be warranted for a period of two years against: discoloration or mismatch of new mortar to adjacent original historic mortar, discoloration or damage to masonry from improper

mortar clean-up, loss of bond between masonry and mortar, fracturing of masonry edges from improper mortar joint preparation procedures or improper mortar formulation, and occurrence of efflorescence.

PART 2 PRODUCTS

2.1 MATERIALS

Materials, physical and chemical properties, and composition of masonry and mortar used in renovation work shall match that of original existing masonry and mortar to be repaired, unless samples and testing determine that existing mixtures and materials are faulty or non-performing.

2.2 CLEANING MATERIALS

2.2.1 Paint Removers

Chemical paint removers shall be manufacturer's water soluble, low toxicity products, effective for removal of paint on masonry without altering, damaging, or discoloring the masonry surface.

2.2.2 Detergent Cleaners

Detergent cleaners shall be in accordance with ASTM D 3399.

2.2.3 Ionic Cleaners

2.2.3.1 Alkaline Prewash Cleaner

Alkaline prewash cleaners shall be as recommended by the manufacturer.

2.2.3.2 One-Part Masonry Cleaner

One-part masonry cleaners shall be the standard, acid formulation recommended by the manufacturer.

2.2.3.3 Two-Part Limestone Cleaner

Two-part limestone cleaners shall be manufacturer's standard, two-part masonry cleaning system consisting of an alkaline prewash cleaner followed by acidic afterwash rinse.

2.2.3.4 Standard Strength Acidic Cleaner

Acidic cleaners shall be manufacturer's standard strength, acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids and combined with special wetting systems and inhibitors.

2.2.3.5 Extra Strength Acidic Cleaner

Masonry restoration extra strength acidic cleaners shall be as recommended by the manufacturer.

2.2.4 Liquid Strippable Masking Agent

Liquid strippable masking agent shall be manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from the damaging effect of acidic and alkaline masonry cleaners.

2.2.5 Spray Equipment

Spray equipment for chemical cleaners shall be low-pressure tanks or chemical pumps suitable for chemical cleaner indicated, and shall be equipped with stainless steel, cone-shaped spray-tip. Spray equipment for

water shall disperse water through a fan-shaped spray tip at an angle of not less than 15 degrees. Spray equipment shall deliver water at a pressure not greater than 500 psi and at a volume between 2.5 and 3 gpm. Spray equipment for heated water shall be capable of maintaining temperature, at flow rates indicated, between 140 and 180 degrees F.

2.2.6 Cleaning Implements

Brushes shall have natural or nylon fiber bristles only. Wire brushes shall not be used. Scrapers and application paddles shall be made of wood with rounded edges. Metallic tools shall not be used.

2.2.7 Water

Potable water shall be obtained from a local source and shall be filtered to remove minerals resulting in a neutral pH, prior to application. Backflow prevention devices shall be provided at the point of connection to the water supply.

2.3 REPAIR MATERIALS

2.3.1 Masonry and Mortar

Masonry and mortar materials used for repair and renovation shall match the original existing historic materials as closely as possible in composition, color, texture, strength, size, finishing and porosity.

2.3.2 Cementitious Materials

Cementitious materials shall be of one type and from one source, when used in mortar which will have surfaces exposed in the finished structure. Cement composition shall match that of cement used in existing mortar to be repaired, as determined by samples and testing, and shall conform to the basic requirements of ASTM C 150, Type II.

2.3.3 Epoxy Anchor Adhesives

An epoxy-resin grout shall be used to bond steel anchors to masonry, and shall be a 100 percent solids, moisture insensitive, low creep, structural adhesive. The epoxy shall conform to ASTM C 881, Type IV; Grade and Class selected to conform to the manufacturer's recommendations for the application.

2.3.4 Metal attachments

Anchors for spall repairs shall be threaded stainless steel, size as indicated. Other plates, angles, anchors, and embedments shall conform to ASTM A 36, and shall be prime painted with inorganic zinc primer.

PART 3 EXECUTION

3.1 EVALUATION AND ANALYSIS

Evaluation and analysis shall conform to the requirements specified herein, and to Section 01451 CONTRACTOR QUALITY CONTROL. Masonry renovation shall be undertaken only after complete evaluation and analysis of the areas to be repaired are completed; this shall include sampling and testing of the existing mortar to determine its composition and qualities. No repair work shall be undertaken until conditions that have caused masonry deterioration have been identified; such conditions shall be corrected, if possible, prior to start of the work.

3.2 MASONRY CLEANING

Historic materials shall not be damaged or marred in the process of

cleaning. Cleaning shall conform to BIA Tech Note 20 Rev II. Open joints shall be temporarily caulked or otherwise protected to prevent water and cleaner intrusion into the interior of the structure from pressure spraying. Non-masonry materials and severely deteriorated masonry shall be protected by approved methods prior to initiation of cleaning operations. Masonry cleaning shall remove all organic and inorganic contaminants from the surface and pores of the substrate, returning the masonry to its natural color. Surfaces shall be evenly cleaned with no evidence of streaking or bleaching. The cleaning process shall not affect the density, porosity, or color of the masonry or mortar. Cleaned masonry shall have a neutral pH. Methods used for cleaning historic masonry shall be the gentlest possible to achieve the desired results. Test patches shall be made to determine a satisfactory cleaning result. Cleaning shall proceed in an orderly manner, working from top to bottom of each scaffold width and from one end of each elevation to the other. Cleaning shall be performed in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to masonry. The cleaning materials, equipment, and methods shall not result in staining, erosion, marring, or other damage to the surfaces of the structure. Following an initial inspection and evaluation of the structure and surfaces, the structure shall be given a surface cleaning. The surface cleaning shall be completed prior to start of repair work, and sampling and testing of mortars. The cleaning shall provide for the complete cleaning of all exterior masonry surfaces of the structures, removing all traces of moss, dirt, and other contaminants. The cleaning shall provide a clean masonry surface to allow determination of the masonry's color and shades, finish and texture, and other properties. Following completion of the surface cleaning of the structure (or side of structure) the masonry shall be dried prior to the start of any repair work. The following sequence of methods shall be used to determine the least aggressive, effective cleaning method:

1. Water with brushes.
2. Water with mild soap.
3. Water with stronger soap.
4. Water with stronger soap plus ammonia.
5. Water with stronger soap plus vinegar (not to be used on calcareous masonry).
6. Stronger chemical cleaners, to be used only if any of the above methods is determined to be ineffective by the Contracting Officer.

3.2.1 Project Conditions

Masonry surfaces shall be cleaned only when air temperatures are above 40 degrees F and will remain so until masonry has dried out, but for not less than 7 days after completion of the work.

3.2.2 Chemical Cleaners

Acidic chemical cleaners shall not be used on limestone, marble, concrete and other calcareous (calcium containing) masonry materials. If chemical cleaners are used on such materials, they shall be alkaline based and utilized with neutralizing afterwashes.

3.2.3 Test Patches

The materials, equipment, and methods to be used in cleaning shall be demonstrated in a test section approximately 3 by 3 ft square. The location of the test section, and the completed test section shall be subject to approval. The cleaning process shall be adjusted as required and the test section rerun until an acceptable process is obtained. Test patches shall be located in inconspicuous areas of the building. The areas tested shall exhibit soiling characteristics representative of those larger areas to be cleaned. Tests shall also be conducted on areas to be stripped of paint. Tested areas shall be allowed to dry before a determination is

made on the effectiveness of a particular treatment.

3.2.4 Paint Removal

Paint and other coatings shall be removed from masonry surfaces in areas indicated prior to general cleaning. Masonry shall not be damaged or marred in the process of paint removal. Areas where paint is to be removed shall first be cleaned with water and detergent solution to remove surface dirt, rinsed, and allowed to dry. Chemical paint removers shall be applied in accordance with manufacturer's instructions. Surrounding painted surfaces to remain intact shall be protected from exposure to chemical paint removers to avoid damage.

3.2.5 Water Cleaning

3.2.5.1 Pressure Spraying

Water shall be spray applied to masonry surfaces to comply with requirements indicated by test patches for location, purpose, water temperature, pressure, volume, and equipment. Unless otherwise indicated, the surface washing shall be done with clean, low pressure water (pressure of less than 55 psi and 2.5 to 3 gpm discharge) and the spray nozzle shall not be held less than 12 inches from surface of masonry. Water shall be applied side to side in overlapping bands to produce uniform coverage.

3.2.5.2 Handscrubbing

Pre-wetted surfaces shall be scrubbed using hand-held natural bristle or nylon brushes. Wire brushes shall not be used. Surfaces to be cleaned shall be scrubbed to remove surface contaminants.

3.2.5.3 Rinsing

Scrubbed surfaces shall be rinsed clean of all contaminants and cleaning solutions with water in a low-to-moderate pressure spray, working upwards from bottom to top of each treated area. The rinsing cycle shall remove all traces of contaminants and cleaning solutions.

3.2.6 Chemical Cleaning

Chemical cleaning of historic masonry shall use the gentlest means possible to achieve the desired result as determined by test patches. Chemical cleaning shall be the use of any product in addition to water, including detergents, ammonia, vinegar, and bleach. Cleaning shall proceed in an orderly manner, working from top to bottom of each scaffold width and from one end of each elevation to the other. Cleaning shall result in uniform coverage of all surfaces, including corners, moldings, interstices and shall produce an even effect without streaking or damage to masonry. Chemical cleaners shall not be applied to the same masonry surfaces more than twice.

3.2.6.1 Surface Prewetting

Masonry surfaces to be cleaned with chemical cleaners shall be wetted with water using a low pressure spray before application of any cleaner.

3.2.6.2 Acidic Chemical Cleaning

Acidic chemical cleaners shall be applied according to manufacturer's instructions. Acidic chemical cleaners shall not be applied to masonry with high calcium content (e.g. marble, limestone). Acidic cleaners shall be applied to masonry surfaces by low pressure spray 50 psi max., roller, or brush. Cleaner shall remain on masonry surface for the time period recommended by manufacturer. Manual scrubbing by brushes shall be employed as indicated by test patches for the specific location. Cleaned surfaces

shall be rinsed with a low-to-moderate pressure spray of water to remove all traces of chemical cleaner.

3.2.6.3 Alkaline Chemical Cleaning - Prewash Phase

Alkaline chemical cleaners shall be applied according to manufacturer's instructions. Alkaline cleaners shall be applied to masonry surfaces by low pressure spray 50 psi max., roller, or brush. Cleaner shall remain on masonry surface for the time period recommended by the manufacturer. Manual scrubbing by brushes shall be employed as indicated by test patches for the specific location. Cleaned surfaces shall be rinsed with a low-to-moderate pressure spray of water.

3.2.6.4 Alkaline Chemical Cleaning - Afterwash Phase

Immediately after rinsing of alkaline cleaned surfaces, a neutralizing afterwash shall be applied to the cleaned masonry areas. Neutralizing afterwash shall be applied according to manufacturer's instructions. Neutralizing afterwash shall be applied to masonry surfaces by low pressure spray 50 psi max., roller, or brush. Afterwash shall remain on masonry surface for the time period recommended by manufacturer. Cleaned surfaces shall be rinsed with a low-to-moderate pressure spray of water to remove all traces of chemical cleaners.

3.2.6.5 pH Testing

Masonry surfaces which have been chemically cleaned shall be pH tested using pH monitoring pencils or papers. Chemically cleaned masonry shall be rinsed of all chemical residues until a neutral pH (7) reading is obtained from the masonry surface.

3.3 MASONRY REPAIR

Repaired surfaces shall match adjacent existing surfaces in all respects. Masonry repair shall proceed only after the cause of deterioration has been identified and corrected. Masonry repair shall conform to ACI Compilation 20. Masonry repair shall proceed only after the area to be repaired has been cleaned. The materials, methods and equipment proposed for use in the repair work shall be demonstrated in test panels. The location, number, size and completed test panels shall be subject to approval. Products shall be used in accordance with the manufacturer's instructions.

3.3.1 Repointing

Repointing work shall be [as directed] [in accordance with [_____]]. Old caulking, grout, or mortar shall be removed from previously repaired cracks where it is failing. Loose particles shall be removed from cracks. Cracks shall be cleaned, rinsed with water followed by blowing with filtered, dry, compressed air.

3.3.1.1 Mortar Analysis

Existing original historic mortar shall be analyzed before repointing in order to provide a match with the new repointing mortar. Historic mortars are usually softer than newer mortars, often using lime as a binder rather than cement. Lime for repointing mortar shall conform to ASTM C 207, Type S, unless otherwise specified. Full laboratory analysis of the existing mortar shall conform to ASTM C 1324. Field analysis of the existing mortar shall be as specified below.

3.3.1.2 Taking and Preparation of Samples

Samples of unweathered original historic mortar shall be taken and analyzed in order to match the new mortar to be used for repointing. Samples of each different type of mortar in the structure shall be taken and analyzed.

Three or four samples of each type of mortar to be matched shall be removed with a hand chisel from several locations on the building. The largest sample shall be set aside for comparison with the repointing mortar. The remaining samples shall be broken apart with a wooden mallet, powdering them into their constituent parts.

3.3.1.3 Binder Analysis

A part of the sample shall be stirred into diluted hydrochloric acid. If a vigorous chemical reaction (bubbling) occurs and most of the binder disappears, leaving clean aggregate, the binder was lime. A portland cement binder will result in a murky liquid and will dissolve very slowly over several days.

3.3.1.4 Aggregate Analysis

Aggregate of the mortar sample shall be separated from the binder. This shall be accomplished by taking the crushed mortar sample and either gently blowing away the fine binder material, placing the crushed sample in a centrifuge, or chemically separating the aggregate from the binder. The separated aggregate shall be rinsed clean with water and dried. The aggregate shall be examined with a magnifying glass, and the component materials shall be recorded as to range of materials, sizes, colors, as well as the presence of other materials.

3.3.2 Mechanical Repair

Original historic masonry materials shall be repaired or replaced only if surfaces are extensively deteriorated (surface missing to a depth of 4 inches or more) or are threatening the safety of the structure or individuals. Deteriorated surfaces shall be removed and repaired or replaced only upon approval. Repairs and replacements shall match the materials, colors, and finish of the existing historic masonry as closely as possible.

3.3.2.1 Areas To Be Removed

Unsound, weak, or damaged masonry and mortar shall be removed in areas as indicated. Loose particles, laitance, spalling, cracked, or debonded masonry and mortar and foreign materials shall be removed with hand tools unless otherwise noted. Surfaces prepared for repair shall be cleaned free of dust, dirt, masonry chips, oil or other contaminants, rinsed with water, and dried before repair work is begun. Surfaces of the structure, and surfaces adjacent to the work area shall be protected from damage which may result from removal, cleaning, and repair operations.

3.3.2.2 Application of Masonry and Mortar

Masonry and mortar shall be placed to rebuild spalled or damaged areas to match the original surface finish, level, texture, and color. The finished appearance of the patch shall match the adjacent existing surface.

3.3.2.3 Patch Anchors

Patch anchors shall be provided to ensure that the patch is tied to the existing masonry structure. Patch anchors shall be provided at a frequency of at least one patch anchor per square foot of patch plan surface area; specific locations for patch anchors shall be as indicated. Small handheld, low-speed rotary masonry drills shall be used to produce holes in the existing masonry, within the limits for the patch anchor installation.

3.3.2.4 Holes

Holes shall be drilled into the existing substrate material of the masonry using rotary (non-hammer) drills. Holes shall have a diameter of 1/8 inch

larger than the anchor diameter. The holes shall be drilled to a depth of 4 inches, except as otherwise indicated or directed. Drill holes shall not penetrate completely through the masonry, and shall provide at least 1 inch of cover around the drill hole. Holes shall be cleaned by water blasting to remove drill dust and other debris and then blown dry with filtered, dry, compressed air. Drill holes shall be conditioned in accordance with the epoxy adhesive manufacturer's recommendations.

3.3.2.5 Anchor Installation

Anchors shall be cleaned to remove all contaminants which may hinder epoxy bond. Epoxy adhesive shall be pressure injected into the back of the drilled holes. The epoxy shall fill the holes without spilling excess epoxy when the anchors are inserted. Anchors shall be inserted immediately into the holes. The anchors shall be set back from the exterior face at least 1 inch. Anchors shall be installed without breaking or chipping the exposed masonry surface.

3.3.2.6 Cleanup

Excess epoxy and spills shall be removed from the surface of the masonry. The surface of the masonry shall be left in a clean and uncontaminated condition. Spills on adjacent surfaces shall also be removed and surfaces repaired as required.

3.3.2.7 Dutchman Repairs

The piecing-in of small patches of masonry to repair or replace damaged areas (Dutchman repair) shall be used in areas indicated. Repair pieces shall be held in place with epoxy with the joint between the new and old materials kept as narrow as possible to maintain the appearance of a continuous surface. Repairs shall be made to blend in with the surrounding original materials as closely as possible.

3.4 EPOXY-RESIN GROUT

The epoxy adhesive shall be conditioned, proportioned, mixed, applied, protected, and cured in accordance with the manufacturer's recommendations, except as otherwise specified herein or indicated on the drawings. The adjacent surfaces and ambient conditions shall be maintained within the manufacturer's recommendations. The patch anchors and epoxy adhesive shall be protected from displacement and disturbances.

3.4.1 Mixing Epoxy-Resin Grout Components

Epoxy-resin grout components shall be mixed in the proportions recommended by the manufacturer. The components shall be conditioned within 70 to 85 degrees F for 48 hours prior to mixing. The two epoxy components shall be mixed with a power-driven, explosion-proof stirring device in a metal or polyethylene container having a hemispherical bottom. The polysulfide curing agent component shall be added gradually to the epoxy-resin component with constant stirring until a uniform mixture is obtained. The rate of stirring shall be such that the entrained air is at a minimum.

3.4.2 Tools and Equipment

Tools and equipment to be used again in the work shall be cleaned before the epoxy-resin grout sets.

3.4.3 Health and Safety Precautions

Full-face shields shall be provided for mixing, blending, and placing operations as required. Protective coveralls and neoprene-coated gloves shall be provided for workers engaged in the operations. Protective creams of a suitable nature for the operation shall be supplied. Adequate fire

protection shall be maintained at mixing and placing operations. Smoking or the use of spark- or flame-producing devices shall be prohibited within 50 feet of mixing and placing operations. The mixing, placing, or storage of epoxy-resin grout or solvent shall be prohibited within 50 feet of any vehicle, equipment, aircraft, or machinery that could be damaged from fire or could ignite vapors from the material.

3.5 MASONRY REPLACEMENT

Masonry shall be replaced with material that matches the original in terms of composition, color, texture, strength, finishing, and porosity as closely as possible. If a few isolated masonry units are to be replaced, each shall be removed without disturbing the surrounding masonry. Deteriorated masonry units and mortar requiring replacement shall be removed by hand chiselling. Adjoining masonry units shall not be damaged during the removal of deteriorated units and mortar. The new element shall be tested for fitting into its space without mortar. If wedges are used to support and align the new unit, they shall be covered with at least 1-1/2 inches of mortar when pointing is complete. The four sides and back of the space shall be covered with sufficient mortar to ensure that there will be no air spaces when the new unit is set. The new unit shall be lined up and set by tapping it into place with a wooden or rubber mallet. Face of new unit shall align with that of existing masonry. Joints shall be repointed to match the rest of the wall after new units have been properly installed and adjusted. Replacement areas shall be cleaned with a non-metallic brush and water to remove excess mortar

3.6 MASONRY AND MORTAR FINISHES AND COLOR

The exposed surfaces of masonry and mortar repair shall match the finish, color, texture, and surface detail of the original surface. Mechanical finishing and texturing may be required to produce the required finish and appearance. The finishing and texturing shall conceal bond lines between the repaired area and adjacent surfaces. The texturing shall provide replication of all surface details, including tooling and machine marks. The equipment used in finishing and texturing shall be a low-impact energy type which will not weaken the patch or damage the patch bond and the adjacent concrete.

3.7 JOINT SEALING

Joint sealing shall be as specified in Section 07900 JOINT SEALING.

3.8 FINAL CLEANING

No sooner than 72 hours after completion of the repair work and after joints are sealed, faces and other exposed surfaces of masonry shall be washed down with water applied with a soft bristle brush, then rinsed with clean water. Discolorations which cannot be removed by these procedures, shall be considered defective work. Cleaning work shall be done when temperature and humidity conditions allow the surfaces to dry rapidly. Adjacent surfaces shall be protected from damage during cleaning operations.

3.9 PROTECTION OF WORK

Work shall be protected against damage from subsequent operations.

3.10 DEFECTIVE WORK

Defective work shall be repaired or replaced, as directed, using approved procedures.

3.11 FINAL INSPECTION

Following completion of the work, the structure shall be inspected for

damage, staining, and other distresses. The patches shall be inspected for cracking, crazing, delamination, unsoundness, staining and other defects. The finish, texture, color and shade, and surface tolerances of the patches shall be inspected to verify that all requirements have been met. Surfaces exhibiting defects shall be repaired as directed.

-- End of Section --

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program Description
AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
AISC ASD/LRFD Vol II	(1992) Manual of Steel Construction Vol II: Connections
AISC LRFD Vol II	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 53	(1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 490	(1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 500	(1996) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(1996) Carbon and Alloy Steel Nuts
ASTM F 436	(1993) Hardened Steel Washers
ASTM F 844	(1990) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(1996) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1 (1994) Lock Washers (Inch Series)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1993) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS D1.1 (1996) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Manual and AISC ASD/LRFD Vol II shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC ASD Manual.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Structural Steel System; GA. Structural Connections; GA.

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

SD-08 Statements

Erection; GA.

Prior to erection, erection plan of the structural steel framing describing all necessary temporary supports, including the sequence of installation and removal.

Welder Qualifications; GA.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B.

2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E.

2.4 NOT USED

2.5 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325, Type 1 with carbon steel nuts conforming to ASTM A 563, Grade C.

2.6 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563, Grade A.

2.7 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with ASTM A 325 or ASTM A 490 bolts.

2.8 WASHERS

Plain washers shall conform to ASTM F 844. Other types, when required, shall conform to ASME B18.21.1, ASTM F 436 or ASTM F 959.

2.9 PAINT

Paint shall conform to SSPC Paint 25.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. Structural steelwork, except surfaces to be field welded shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

3.2 ERECTION

Erection of structural steel shall be in accordance with the applicable provisions of AISC ASD Manual.

3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and

similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

-- End of Section --

SECTION 05300

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI-01	(1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 611	(1996) Steel, Sheet, Carbon, Cold-Rolled, Structural Quality
ASTM A 653/A 653M	(1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

STEEL DECK INSTITUTE (SDI)

SDI-02	(1987; Amended 1991) Diaphragm Design Manual
SDI Pub No 29	(1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Deck Units; GA.

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

SD-04 Drawings

Deck Units; GA. Accessories; GA. Attachments; GA. Holes and Openings; GA.

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of fastener connections; and the manufacturer's erection instructions.

SD-13 Certificates

Deck Units; GA.

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI Pub No 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 2 inchlaps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI-01, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 NOT USED

2.1.2 NOT USED

2.1.3 NOT USED

2.1.4 Form Deck

Deck used as a permanent form for concrete shall conform to ASTM A 653/A 653M or ASTM A 611. Deck used as a form for concrete shall be fabricated of 0.019 inch design thickness or thicker steel, and shall be zinc-coated in conformance with ASTM A 653/A 653M, G90 coating class.

2.2 TOUCH-UP PAINT

Touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No 29 and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

3.2 NOT USED

3.3 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be fastened with screws, powder-actuated fasteners or pneumatically driven fasteners to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 29. Holes and similar defects will not be acceptable. Deck ends shall be lapped 2 inches. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI-02. Powder-actuated fasteners shall be driven with a low-velocity piston tool by an operator authorized by the manufacturer of the piston tool. Pneumatically driven fasteners shall be driven with a low-velocity fastening tool and shall comply with the manufacturer's recommendations.

-- End of Section --

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1980; R 1993) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI MH28.1	(1982) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1996) Carbon Structural Steel
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 653	(1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924	(1996a) Steel Sheet, Metallic-Coated by the Hot-Dip Process

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1993) Metal Bar Grating Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Miscellaneous Metal Items; GA.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation

instructions, and templates. Detail drawings for the following items: Steel door frames, mirror frames.

SD-14 Samples

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 653, or ASTM A 924, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have anodized finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and

shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16 gauge steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 14 by 20 inches and of not lighter than 14 gauge steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have a shop applied prime coat.

2.2 NOT USED

2.3 NOT USED

2.4 NOT USED

2.5 NOT USED

2.6 NOT USED

2.7 NOT USED

2.8 NOT USED

2.9 NOT USED

2.10 NOT USED

2.11 NOT USED

2.12 NOT USED

2.13 NOT USED

2.14 HANDRAILS

Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail or 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

2.14.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A 53. Steel railings shall be 1-1/2 inch nominal size. Railings shall be hot-dip galvanized and shop painted. Pipe collars shall be hot-dip galvanized steel.

a. Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and

reinforced by a tight fitting interior sleeve not less than 6 inches long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

b. Removable sections, toe-boards, and brackets shall be provided as indicated.

2.15 NOT USED

2.16 NOT USED

2.17 NOT USED

2.18 MIRROR FRAMES

Frames for plate glass mirrors larger than 18 by 30 inches shall be fabricated from corrosion-resisting steel with satin finish. Frames shall be provided with concealed fittings and tamperproof mountings.

2.19 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.20 NOT USED

2.21 NOT USED

2.22 NOT USED

2.23 NOT USED

2.24 NOT USED

2.25 SHELVING

Shelving shall conform to ANSI MH28.1 and shall be bolted and capable of resisting a uniform load of 100 lbs per foot. Minimum dimensions and number of shelves shall be as indicated.

2.26 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, metal pan cement-filled treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36. Stairs and accessories shall be galvanized. Risers on stairs with metal pan treads shall be deformed to form a sanitary cove to retain the tread concrete. Integral nosings shall have braces extended into the concrete fill. Gratings for treads and landings shall conform to NAAMM MBG 531. Grating treads shall have slip-resistant nosings.

2.27 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 2 by 1/4 by 12 inch bent, adjustable metal anchors spaced not over 2 feet 6 inches on centers. Provision shall be made to stiffen the top member for all spans over 3 feet. Continuous door stops shall be made of 1-1/2 by 5/8 inch bars.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 NOT USED

3.3 NOT USED

3.4 DOOR GUARD FRAME

Door guard frame shall be mounted over the glazed opening using 1/4 inch lag bolts on the interior of wood doors or tamperproof through bolts on the interior of metal doors.

3.5 INSTALLATION OF PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete having a compressive strength of 3000 psi.

3.6 NOT USED

3.7 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.7.1 Installation of Steel Handrails

Installation shall be in pipe sleeves embedded in concrete and filled with molten lead or sulphur with anchorage covered with standard pipe collar pinned to post and/or base plates bolted to stringers or structural steel framework. Rail ends shall be secured by steel pipe flanges through-bolted to a back plate or by 1/4 inch lag bolts to studs or solid backing.

3.8 NOT USED

3.9 NOT USED

3.10 NOT USED

3.11 RECESSED FLOOR MATS

Contractor shall verify field measurements prior to releasing materials for fabrication by the manufacturer. A mat frame shall be used to ensure recess accuracy in size, shape and depth. Drain pit shall be formed by blocking out concrete when frames are installed. Pit shall be dampproofed after concrete has set. Frames shall be assembled onsite and installed so that upper edge will be level with finished floor surface. A cement base shall be screeded inside the mat recess frame area using the edge provided by the frame as a guide. The frame shall be anchored into the cement with anchor pins a minimum of 24 inches on centers.

3.12 NOT USED

3.13 NOT USED

3.14 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap screwed with countersunk screws at no more than 18 inchcenters, assuring in

either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

-- End of Section --

SECTION 05502

METALS: MISCELLANEOUS, STANDARD ARTICLES, SHOP FABRICATED ITEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 1	(1992) Carbon Steel Tee Rails
ASTM A 20/A 20M	(1996a) General Requirements for Steel Plates for Pressure Vessels
ASTM A 27/A 27M	(1995) Steel Castings, Carbon, for General Application
ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 109	(1993) Steel, Strip, Carbon, Cold-Rolled
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 148/A 148M	(1993b) Steel Castings, High-Strength, for Structural Purposes
ASTM A 153/A 153M	(1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 193/A 193M	(1996b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(1996) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 240/A 240M	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 263	(1994a) Corrosion-Resistant Chromium Steel-Clad Plate, Sheet, and Strip
ASTM A 264	(1994a) Stainless Chromium-Nickel Steel-Clad Plate, Sheet, and Strip
ASTM A 276	(1996) Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
ASTM A 312/A 312M	(1995a) Seamless and Welded Austenitic

	Stainless Steel Pipes
ASTM A 320/A 320M	(1994; R 1995) Alloy Steel Bolting Materials for Low-Temperature Service
ASTM A 325	(1996) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 484/A 484M	(1994b) General Requirements for Stainless Steel Bars, Billets, and Forgings
ASTM A 490	(1993) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 500	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1993) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 502	(1993) Steel Structural Rivets
ASTM A 504	(1993) Wrought Carbon Steel Wheels
ASTM A 514/A 514M	(1994a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A 516/A 516M	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 519	(1994) Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM A 564/A 564M	(1995) Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A 572/A 572M	(1994c) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1994) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 618	(1993; R 1995) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 668/A 668M	(1996) Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A 730	(1993) Forgings, Carbon and Alloy Steel, for Railway Use
ASTM A 786/A 786M	(1993) Rolled Steel Floor Plates
ASTM B 6	(1995a) Zinc
ASTM B 21	(1996) Naval Brass Rod, Bar, and Shapes
ASTM B 23	(1994) White Metal Bearing Alloys (Known

	Commercially as "Babbitt Metal")
ASTM B 26/B 26M	(1996) Aluminum-Alloy Sand Castings
ASTM B 36/B 36M	(1995) Brass Plate, Sheet, Strip, and Rolled Bar
ASTM B 62	(1993) Composition Bronze or Ounce Metal Casting
ASTM B 121/B 121M	(1995) Leaded Brass Plate, Sheet, Strip, and Rolled Bar
ASTM B 124	(1996) Copper and Copper-Alloy Forging Rod, Bar, and Shapes
ASTM B 138	(1996) Manganese Bronze Rod, Bar, and Shapes
ASTM B 148	(1993a) Aluminum-Bronze Sand Castings
ASTM B 150	(1995a) Aluminum Bronze Rod, Bar, and Shapes
ASTM B 152	(1994) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 176	(1995) Copper-Alloy Die Castings
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 211	(1995a) Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B 241/B 241M	(1996) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 271	(1996) Copper-Base Alloy Centrifugal Castings
ASTM B 308/B 308M	(1996) Aluminum-Alloy 6061-T6 Standard Structural Shapes
ASTM B 505	(1996) Copper-Base Alloy Continuous Castings
ASTM B 584	(1993b) Copper Alloy Sand Castings for General Applications
ASTM B 749	(1991; R 1991) Lead and Lead Alloy Strip, Sheet, and Plate Products
ASTM B 763	(1996) Copper Alloy Sand Castings for Valve Application
ASTM B 806	(1993a) Copper Alloy Permanent Mold Castings for General Applications
ASTM B 824	(1996) General Requirements for Copper Alloy Castings
ASTM F 436	(1993) Hardened Steel Washers

ASME INTERNATIONAL (ASME)

ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(1981; Supple 1991; R 1992) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)
ASME B18.3	(1986; R 1995) Socket Cap, Shoulder and Set Screws (Inch Series) Including Dimensions of Hexagon and Spline Sockets and Keys to Match
ASME B18.6.1	(1981; R 1991) Wood Screws (Inch Series)
ASME B18.6.2	(1972; R 1993) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws
ASME B18.6.3	(1972; R 1991) Machine Screws and Machine Screw Nuts
ASME B18.21.1	(1994) Lock Washers (Inch Series)
ASME B18.22.1	(1965; R 1990) Plain Washers
ASME B27.7	(1977; R 1993) General Purpose Tapered and Reduced Cross Section Retaining Rings

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1922	(Rev A) Shield, Expansion (Caulking Anchors, Single Lead)
CID A-A-1923	(Rev A) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 1) Shield, Expansion (Shelf Drilling Tubular Expansion Shell Bolt Anchors)
CID A-A-1925	(Rev A; Notice 1) Shield, Expansion (Nail Anchors)
CID A-A-55614	(Rev A) Shield, Expansion (Non-Drilling Expansion Anchors)
CID A-A-55615	(Rev A) Shield, Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)
CID A-A-60005	(Rev E; Notice 1) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

ENGINEERING MANUALS (EM)

EM 385-1-1	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

FEDERAL SPECIFICATIONS (FS)

FS RR-C-271	(Rev D) Chains and Attachments, Welded and Weldless
FS RR-W-410	(Rev D; Am 1) Wire Rope and Strand

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1993) Metal Bar Grating Manual
NAAMM MBG 531S	(1989) Guide Specification for Stainless Steel Grating

1.2 LUMP SUM PRICE

1.2.1 Metalwork Fabrication, Machine Work, Miscellaneous Provisions

1.2.1.1 Payment

Payment shall constitute full compensation for furnishing all plant, labor, materials and equipment and performing all operations necessary for the metalwork fabrication, machine work, miscellaneous provisions as specified.

1.2.1.2 Unit of Measure

Unit of measure: lump sum.

1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Shop Fabricated Metal Items; GA.

Detail drawings shall be submitted for approval as specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-07 Schedules

Miscellaneous Metals and Standard Metal Articles; GA. Shop Fabricated Metal Items; GA.

Lists of materials shall be submitted for approval as specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-09 Reports

Miscellaneous Metals and Standard Metal Articles; GA. Shop Fabricated Metal Items; GA.

Certified test reports for materials tests and analyses shall be submitted for approval as specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

SD-14 Samples

Miscellaneous Metals and Standard Metal Articles; GA. Shop Fabricated Metal Items; GA.

Samples shall be submitted for approval as specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS. Samples of standard or fabricated items shall be full size and complete as required for installation in the work, and may be installed in the work, provided each sample is clearly identified and its location recorded.

SD-18 Records

Miscellaneous Metals and Standard Metal Articles; GA. Shop Fabricated Metal Items; GA.

Records which identify the disposition of approved material and fabricated items in the work must be submitted for approval as specified and in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

1.4 FABRICATION AND WORKMANSHIP REQUIREMENTS

Fabrication requirements and workmanship provisions for items specified in this section shall conform with the requirements of Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

PART 2 PRODUCTS

2.1 MISCELLANEOUS METALS AND STANDARD METAL ARTICLES

Miscellaneous metal materials and standard metal articles shall conform to the respective specifications and other designated requirements. Sizes shall be as specified or shown. Where material requirements are not specified, materials furnished shall be suitable for the intended use and shall be subject to approval.

2.1.1 Structural Steel

[[ASTM A 36/A 36M] [ASTM A 572/A 572M] Grade [_____], Type [_____]] [ASTM A 588/A 588M, Grade [_____]].

2.1.2 Steel Plates

2.1.2.1 Structural

ASTM A 514/A 514M, Grade [_____].

2.1.2.2 Pressure Vessel

ASTM A 516/A 516M, Grade [_____], and shall meet the requirements of the Charpy V-notch impact tests and the drop-weight tests as specified in ASTM A 20/A 20M.

2.1.3 Steel Tubing

2.1.3.1 Structural

ASTM A 500, Grade [_____], [[ASTM A 501] [ASTM A 618], Grade [_____]], [seamless] [welded], [outside diameter] [outside dimensions] and nominal wall thickness as shown.

2.1.3.2 Mechanical

ASTM A 519 [seamless carbon] [alloy steel mechanical tubing], [hot finished] [cold finished], Conditions [_____] and [_____], Grade dimensions as shown.

2.1.4 Steel Pipes and Pipe Fittings

2.1.4.1 Pipes

ASTM A 53, Type [E][S], Grade [A][B], [seamless] [electric-resistance welded], [black] [galvanized], nominal size and weight class or outside diameter and nominal wall thickness as shown, [plain] [threaded] [threaded and coupled] ends.

2.1.4.2 Pipe Fittings

a. Flanged - ASME B16.5, Class [_____], faced and drilled.

b. Screwed - ASME B16.3, Type [_____].

c. Butt-welding - ASME B16.9.

2.1.5 Stainless Steel

2.1.5.1 Plate, Sheet, and Strip

ASTM A 240/A 240M, UNS [S30400,] [S40500] or [S41008]. Plate finish shall be hot-rolled and annealed or heat treated, and blast cleaned or pickled. Sheet and strip finish shall be No. 1.

2.1.5.2 Clad Plate

ASTM A 263, with cladding conforming to ASTM A 240/A 240M, UNS S40500 or S41008; or ASTM A 264, with cladding conforming to ASTM A 240/A 240M, UNS S30400. Cladding shall be bonded on one side of base metal. Nominal thickness of the cladding shall be 10 percent of the nominal total plate thickness or 1/16 inch, whichever is greater. The thickness of the cladding shall not vary under the thickness specified by more than 2 percent of the nominal thickness of the clad plate. Plate finish shall be sandblasted, pickled, or, blast-cleaned and pickled. Stainless steel plate specified above in paragraph PLATE, SHEET, AND STRIP may be used in lieu of clad plate at the option of the Contractor.

2.1.5.3 Bars and Shapes

Stainless steel bars and shapes shall conform to the following as specified or shown:

a. ASTM A 276, UNS [S30400, S40500, or S41000 with a maximum carbon content of 0.08 percent] [S21800], Condition A, hot-finished or cold-finished, Class C.

b. ASTM A 564/A 564M, UNS S17400 or S45000, age-hardened heat treatment condition, hot-finished or cold-finished, Class C.

2.1.5.4 Plates, Bars & Shapes for Roller & Track Systems

a. Gate Rollers and Bolted Track Plates - ASTM A 564/A 564M, UNS S17400 or S45000, age-hardened heat treated to obtain a Brinell hardness range of 331 minimum to 401 maximum, hot-finished or cold-finished, Class C. Heat treatment of rollers and plates shall not commence until the heat treatment procedure and the test reports for other required material tests are approved. After heat treating and final machining, each roller and track plate shall be free of scale and cracks, as determined by magnetic particle, florescent, or dye penetrant inspection tests.

(1) Hardness Check Tests - Suitable 1/2 inch thick samples of the material from each heat shall be tested to determine the hardness in both the solution-annealed and age-hardened conditions. Where the oven-batch heat- treating process is used, hardness check tests shall be performed on material of each heat in each oven batch. Where a continuous heat-treating process is used, three

check tests shall be performed on material of each heat: one on the first material through the process, one at the middle of the run, and one on the last material through the process.

b. Fasteners for Bolted Track Plates and Guide Bars - Bolting materials shall conform to ASTM A 193/A 193M or ASTM A 320/A 320M, Class 2, Grade B8 Nuts shall conform to ASTM A 194/A 194M, Grade 8A.

c. Gate Roller Links and Pins

(1) Links - ASTM A 276, UNS S30400 or S41000, Condition A, hot-finished or cold-finished, Class A.

(2) Pins - ASTM A 276, UNS S21800, Condition A, cold-finished or hot-rolled and machine-finished to the tolerances specified in ASTM A 484/A 484M for cold-finished round bars, Class C.

d. Retaining rings for gate roller links shall be corrosion resistant steel conforming to ASME B27.7, BASIC external series type with nominal ring size of [_____] inches.

e. Seal Plates, Bars, and Retainers; Roller Guide Bars; and Track Plates.

(1) Welded Seal Plates and Bars; Welded Roller Guide Bars; and Welded Track Plates - ASTM A 240/A 240M, UNS [S40500] [S41008] [S30400], Hot-Rolled and Annealed or Heat Treated, and Blast Cleaned or Pickled Finish; or ASTM A 276, UNS S30400, S40500, or S41000 with a maximum carbon content of 0.08 percent, Condition A, Hot-Finished or Cold-Finished, Class C.

(2) Bolted Seal Plates, Bars, and Retainers; and Bolted Roller Guide Bars - ASTM A 240/A 240M, UNS [S40500] or [S41008] [S30400], Hot-Rolled and Annealed or Heat Treated, and Blast Cleaned or Pickled finish; or ASTM A 276, UNS S30400, S40500, or S41000, Condition A, hot-finished or cold-finished, Class C.

2.1.5.5 Pipe

ASTM A 312/A 312M, [seamless] [welded], UNS S30400, NPS and schedule number or outside diameter and nominal wall thickness as shown, [plain] [threaded] [threaded and coupled] ends.

2.1.6 Steel Forgings

2.1.6.1 General Industrial Use

ASTM A 668/A 668M, Class [_____], carbon content not exceeding 0.35 percent, and an overall chemical composition which results in satisfactory weldability.

2.1.6.2 Railway Use

ASTM A 730, Grade [_____], carbon content not exceeding 0.35 percent and an overall chemical composition which results in satisfactory weldability.

2.1.7 Steel Castings

ASTM A 27/A 27M, Grade [_____], Class [_____], or ASTM A 148/A 148M, Grade [_____].

2.1.8 Steel Strips

ASTM A 109, [oiled] [not oiled], Temper [_____] Edge [_____], Finish [_____].

2.1.9 Aluminum

2.1.9.1 Sheets and Plates

ASTM B 209, Alloy [_____], Temper [_____].

2.1.9.2 Bars, Rods and Wire

ASTM B 211, Alloy [_____], Temper [_____].

2.1.9.3 Structural Shapes

ASTM B 308/B 308M, Alloy [_____], Temper [_____].

2.1.9.4 Castings

ASTM B 26/B 26M, Alloy [_____], Temper [_____].

2.1.9.5 Pipes and Tubes

ASTM B 241/B 241M, Alloy 6063, Temper [_____], size and schedule number or outside diameter and wall thickness as shown.

2.1.10 Bronze

2.1.10.1 Copper Alloy Castings

[ASTM B 148] [ASTM B 62] [ASTM B 176] [ASTM B 271] [ASTM B 505] [ASTM B 584] [ASTM B 763] [ASTM B 806], Copper Alloy UNS No. [_____].

a. General requirements of ASTM B 824:

(1) Pressure tests

(2) Certification

(3) Witness tests

(4) [_____]

b. Optional requirements of [ASTM B 148] [ASTM B 62] [ASTM B 176] [ASTM B 271] [ASTM B 505] [ASTM B 584] [ASTM B 763] [ASTM B 806] [ASTM B 824].

(1) Soundness

(2) Mechanical properties

(3) Chemical analysis of residual elements

(4) [_____]

2.1.10.2 Aluminum Bronze Castings

[ASTM B 148] [ASTM B 271] [ASTM B 505] [ASTM B 763] [ASTM B 806], Copper Alloy UNS No. [_____].

2.1.10.3 Aluminum Bronze Rods, Bars, and Shapes

ASTM B 150, Copper Alloy UNS No. [_____], Temper [_____].

2.1.10.4 Manganese Bronze Castings

[ASTM B 176] [ASTM B 271] [ASTM B 505] [ASTM B 584] [ASTM B 763], Copper

Alloy UNS No. [_____].

2.1.10.5 Rolled Manganese Bronze and Manganese Bronze Forgings
ASTM B 138, Class [_____], Temper [_____].

2.1.10.6 Manganese Bronze Rods, Bars, and Shapes

ASTM B 138, Copper Alloy UNS No. [_____],
Temper [_____].

2.1.11 Brass

2.1.11.1 Sheet, Plates, and Bars

[ASTM B 36/B 36M] [ASTM B 121/B 121M], Composition [_____], Temper [_____].

2.1.11.2 Castings

[ASTM B 62] [ASTM B 176] [ASTM B 271] [ASTM B 505] [ASTM B 584] [ASTM B 763] [ASTM B 806], Copper Alloy UNS No. [_____].

2.1.11.3 Naval Brass

[ASTM B 21,][ASTM B
124,] Composition [_____], Temper [_____].

2.1.12 Copper Flat Products

ASTM B 152, Temper [_____].

2.1.13 Lead Sheet

ASTM B 749, Alloy UNS No. [_____], Type [L_____].

2.1.14 Zinc

ASTM B 6, [Special High Grade] [High Grade] [Prime Western].

2.1.15 Babbit Metal

ASTM B 23, Alloy UNS No. [_____].

2.1.16 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall be of the material, grade, type, class, style and finish indicated or best suited for intended use.

2.1.16.1 High-Strength Bolts, Nuts, and Washers

ASTM A 325, Type [_____], [hot-dip galvanized] or ASTM A 490, Type [_____].

2.1.16.2 Bolts, Nuts, and Washers (Other Than High-Strength)

a. Bolts and Nuts - ASTM A 307, Grade A, [hot-dip galvanized] or ASTM A 320/A 320M, [Ferritic Steel, Grade [_____]] [Austenitic Steel, Class [_____]].

b. Bolts - ASME B18.2.1.

c. Nuts - ASME B18.2.2.

d. Washers

(1) Plain Washers - ASME B18.22.1, Type B.

(2) Lock Washer - ASME B18.21.1.

(3) Beveled Washers - ASTM F 436, Type [_____], Beveled.

2.1.17 Screws

Screws shall be of the material, grade, type, style, and finish indicated or best suited for use intended.

2.1.17.1 Cap Screws

ASME B18.2.1, ASME B18.3, or ASME B18.6.2 as required.

2.1.17.2 Machine Screws

ASME B18.6.3.

2.1.17.3 Wood Screws

ASME B18.6.1.

2.1.17.4 Set Screws

ASME B18.6.2.

2.1.18 Expansion Anchors

[CID A-A-1922][CID A-A-1923][CID A-A-1924][CID A-A-1925][CID A-A-55614][CID A-A-55615], type as required, except that nail driven types will not be acceptable, galvanized unless otherwise indicated.

2.1.19 Toggle Bolts

Toggle bolts shall have spring action snap open wings and require a predrilled hole. Screws and sheet metal wings shall be made of zinc-plated steel.

2.1.20 Rivets

ASTM A 502, Grade [_____].

2.1.21 Safety Treads

Treads shall slip-on skid resistant and made from [rubber] [vinyl] [aluminum alloy] [cast iron] as best suited for the intended location.

2.1.22 Wire Rope

FS RR-W-410, Type [_____], Class [_____], Construction [_____], [wire sizes] [strand seizing] as shown.

2.1.23 Chains and Attachments

FS RR-C-271, Type [_____], Grade [_____], Class [_____], Style [_____], Size [_____], Finish [_____].

2.1.24 Steel Rails

ASTM A 1, [No. 1] [No. 2].

2.1.25 Cast Iron Frames and Covers

CID A-A-60005, Type [_____], Style [_____] frame, type [_____] cover.

2.1.26 Steel Wheels

ASTM A 504, Class [_____], design and rough bore size as shown.

2.1.27 Floor Gratings

NAAMM MBG 531 and NAAMM MBG 531S.

a. Description of grating: [_____].

b. Anchorage: [_____].

c. Finish: [steel] [steel zinc-coated in accordance with ASTM A 123 after fabrication, and steel hardware and fasteners completely zinc-coated in accordance with ASTM A 153/A 153M] [stainless steel] [aluminum].

2.1.28 Steel Floor Plate

ASTM A 786/A 786M, Pattern No. [1] [2] [3] [4] [5].

2.2 SHOP FABRICATED METAL ITEMS

Shop fabricated metal items shall conform to the requirements and details as specified or shown and to the workmanship provisions and other applicable fabrication requirements as specified in Section 05055 METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.2.1 Railings

Railings shall be of the type specified and shown and shall be furnished and installed complete with all fittings, brackets, fasteners, sleeves, anchors, and other appurtenances as shown and as required for proper installation.

2.2.1.1 Materials

Aluminum railings shall be of pipe or tube as specified in paragraph PIPES AND TUBES. Steel railings shall be of steel as specified in paragraph PIPE. Sleeves and other appurtenances shall be of the same material as the rails and posts or approved compatible materials.

2.2.1.2 Fabrication

Rigid joints in railings shall be of welded, threaded, or slip-on fittings assembly [and shall be flush-finished]. Welded joints shall be reinforced with tight-fitting interior sleeves and shall be assembled by welding rails and posts to flush-type fittings, or by mitering and welding joining rails and posts. Assembled threaded joints shall have no exposed threads. Slip-on fittings shall be tight-fitting. Fasteners for slip-on fittings shall be the self-locking, concealed type. Fasteners for aluminum fittings shall be of aluminum or stainless steel. Fasteners for steel fittings shall be of stainless steel. Expansion joints in railings shall be an [inner-sleeved] [outer-sleeved] [outer-sleeved or inner-sleeved] slip-joint, with one end of the sleeve secured to one rail and the ends of the adjoining rails separated a minimum of 1 inch in the installed position. Expansion joints shall be located in rails near the intersection of rails and posts Bends in railings shall be made in a manner that railings are not crushed and shall maintain their original cross-sectional shape. Welds shall be ground smooth. Railings shall be free of burrs, sharp corners, and sharp edges. For railings of other than welded assembly, manufacturer design calculations, showing that the installed railings are capable of withstanding a design working load of [200][_____] pounds applied in any direction at any point on the top rail without permanent deformation, must be submitted and approved prior to installation.

2.2.1.3 Installation

Railings shall be installed as specified and shown. Railing posts anchored to concrete surfaces perpendicular to the posts shall be [set in sleeve inserts anchored in the concrete, and the space between posts and sleeves shall be filled with molten lead, sulphur, or a quick-setting hydraulic cement and covered with standard collar fittings secured to the posts. A 1/4 inch drain hole shall be drilled near the bottom of each post.] [rigidly secured to flange fittings anchored to concrete with expansion anchors.] Railing posts anchored to concrete surfaces parallel to the posts shall [have the sides of posts continuously welded to base plates] [be rigidly secured to flange fittings] anchored to concrete with expansion anchors. Railing posts anchored to structural metal shall be [welded to base plates] [rigidly secured to flange fittings] [bolted] [welded] to structural metal. Ends of rails anchored to concrete or masonry shall be rigidly secured to flange fittings anchored to concrete or masonry with expansion anchors

2.2.2 Gratings and Cover Plates

Grating and cover plates shall be of the material and size shown, and shall be fabricated in sectional panels of the width and length shown, or as appropriate, to accurately fit within the supporting recess frames. Openings through panels shall be provided as shown or as required. [Hinged panels shall be provided with hinges of the type shown or suitable for the application.] [Steel gratings and cover plates shall be galvanized after fabrication.]

2.2.2.1 Grating

Gratings shall be as specified in paragraph FLOOR GRATINGS. Edges of gratings and openings through gratings which require the cutting of more than one bearing bar shall be banded. Fasteners shall be of the type recommended by the manufacturer and approved. [Stair tread gratings shall have nonslip nosings.]

2.2.2.2 Cover Plates

Cover plates shall be as specified in paragraph STEEL FLOOR PLATE. Cover plate panels shall be provided with [holes for insertion of removal tool] [1/4 inch bar, flush, drop handles for removal] as shown or as required. Sharp edges and burrs shall be removed from plates.

2.2.3 Steel Stairs

Steel stairs shall be fabricated and installed as shown. All materials shall be galvanized after fabrication. Stringers, [columns] and other structural framing members shall be of structural steel shown. Stringers shall have exposed ends closed [and shall be continued around landings which they support]. Stair treads [and landings] shall be fabricated of steel gratings of the type specified in paragraph GRATING. Bolts, nuts and other fastenings shall be provided as shown and as required for proper installation. Lock washers shall be used under all nuts. [Railings of the type specified above in paragraph RAILINGS shall be anchored to stairs as shown.]

2.2.4 Recess Frames

Recess frames shall be fabricated of structural shapes of the type shown. Welded joints in frames shall be ground smooth. [Steel frames shall be galvanized after fabrication.] Frames shall be anchored to supports in the manner shown and shall not be continuous across contraction or expansion joints.

2.2.5 Ladders

Ladders shall be fixed-rail metal ladders conforming to the requirements of EM 385-1-1 and to details shown. Ladders shall be fabricated of [structural steel as shown and shall be galvanized after fabrication] [aluminum as shown]. Fabrication of ladders shall consist of solid-section rod rungs fitted into holes in bar side rails and welded. Splices in side rails shall be made using full penetration welds and shall provide a flush and smooth transition between connecting ends. All welds shall be ground smooth Ladder rails shall be welded to bent-bar supporting brackets anchored to supporting structure as shown.

2.2.6 [Ladder Rungs] [Grab Bars] [Pulling Irons] [Mooring Rings]

[Ladder rungs], [grab bars], [pulling irons], [mooring rings] shall be fabricated from steel rods in accordance with the details and shall be galvanized after fabrication.

2.2.7 Lock Wall Armor

Lock wall armor tees and preformed corner protection plates shall be fabricated from steel conforming to ASTM A 36/A 36M, except that minimum yield strength shall be 33,000 psi, maximum tensile strength shall be waived, and the maximum allowable manganese content shall be 1.40 percent. Tees may be commercially rolled sections or may be fabricated from steel plates provided they have a nominal weight of not less than 28.2 pounds per foot and conform essentially to details shown. Installation shall conform to details shown. Tees and preformed plates shall be erected true to line and grade. The continuous edges of exposed faces shall not have a vertical or horizontal distortion from a straight line greater than 0.025 inch per foot of length. Distortion for any single section shall not exceed 1.4 inches. Where there is a warp in the installed tees or preformed plates greater than 1/16 inch, an extra anchor shall be installed at the proper location to draw the section into position. Bolt heads on exposed faces shall be counter sunk and fitted so that they are flush with the finished surfaces. Joints between abutting sections shall be square and the butting ends shall be sawed or otherwise made smooth and regular.

2.2.8 Lock Wall Line Hooks and Check Posts

Lock wall line hooks and check posts shall be fabricated of alloy steel mechanical tubing as specified in paragraph MECHANICAL. Dimensions, including outside diameter and wall thickness, and anchor bars shall be as shown.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 06114

WOOD BLOCKING AND CURBING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof curbs and cants.

B. Blocking in wall and roof openings.

C. Wood furring and grounds.

D. Concealed wood blocking for support of toilet and bath accessories and wall cabinets.

E. Telephone and electrical panel boards.

F. Preservative treatment of wood.

1.2 RELATED SECTIONS

A. Section 07531 - Elastomeric Sheet Roofing - Fully Adhered.

B. Section 07710 - Manufactured Roof Specialties.

1.3 REFERENCES

A. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.

B. APA: American Plywood Association.

C. AWPA (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.

D. AWPA (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.

E. NFPA: National Forest Products Association.

F. SPIB: Southern Pine Inspection Bureau.

G. WCLIB: West Coast Lumber Inspection Bureau.

H. WWPA: Western Wood Products Association.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:

1. Lumber Grading Agency: Certified by SPIB, WCLIB, and WWPA.
2. Plywood Grading Agency: Certified by APA.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: NFPA SPIB WCLIB WWPA.

B. Miscellaneous Framing: Stress Group D Southern Pine species, 19 percent maximum moisture content, pressure preservative treat.

C. Plywood: APA Structural I, Grade C-D with exterior glue; Exposure Durability 1; sanded.

D. Roof Blocking: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.

E. Telephone and Electrical Panel Boards: 3/4 inch thick, square edges, site brush applied preservative treated.

2.2 ACCESSORIES

A. Fasteners and Anchors:
1. Fasteners: Hot-dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA Treatment C1 using water borne preservative with 0.25 percent retainage.

PART 3 EXECUTION

3.1 FRAMING

A. Set members level and plumb, in correct position.

B. Place horizontal members flat, crown side up.

C. Construct curb members of single pieces.

D. Space framing and furring 16 inches o.c.

E. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

F. Coordinate curb installation with installation of decking and support of deck openings, parapet construction.

3.2 SHEATHING (PLYWOOD)

A. Secure sheathing to framing members with ends over firm bearing and staggered.

B. Install telephone and electrical panel boards with plywood sheathing material where required. Over size the panel by 12 inches on all sides.

3.3 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry items, other than shop prefabricated casework.

B. Hardware and attachment accessories.

C. Fiberglass column cover.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 06114 - Wood Blocking and Curbing: Installation of recessed wood blocking and nailers.

1.3 RELATED SECTIONS

A. Section 06114 - Wood Blocking and Curbing: Grounds and support framing.

B. Section 08211 - Flush Wood Doors.

C. Section 09900 - Painting: Painting and finishing of finish carpentry items.

1.4 REFERENCES

A. ANSI A135.4 - Basic Hardboard.

B. ANSI A208.1 - Mat Formed Wood Particleboard.

C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

D. AWI - Quality Standards.

E. AWPA (American Wood Preservers Association) C2 - Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.

F. AWPA (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.

G. BHMA A156.9 - Cabinet Hardware.

H. FS MMM-A-130 - Adhesive, Contact.

I. HPMA (Hardwood Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.

J. NEMA (National Electric Manufacturers Association) LD3 - High Pressure Decorative Laminates.

K. NHLA (National Hardwood Lumber Association).

L. NWWDA (National Wood Window and Door Association) I.S.4 - Water Repellant Preservative Treatment for Millwork.

M. PS 1 - Construction and Industrial Plywood.

N. PS 20 - American Softwood Lumber Standard.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, accessories, and to a minimum scale of 1-1/2 inch to 1 ft.

B. Samples:

1. Submit two samples, 2" x 2" of each plastic laminate and solid surfacing material scheduled, illustrating color and texture.

2. Submit two samples, 6 inch long of each chair rail scheduled, illustrating size, shape and mitered termination.

C. Product Data: Submit manufacturers descriptive catalog literature containing information verifying products comply with these specifications.

D. Hardware Instruction: Provide instructions for attachment, hardware and finish hardware.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with AWI Custom quality.

1.7 QUALIFICATIONS

A. Fabricator: Company specializing in fabricating the products specified in this section with minimum four years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-

ventilated areas, and protected from extreme changes in temperature and humidity.

B. Protect work from moisture damage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings instructed by the manufacturer.

1.10 COORDINATION

A. Coordinate the work with plumbing and electrical rough-in, installation of associated and adjacent components.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Wood Particleboard: ANSI A208.1 Type 1; AWI standard, composed of wood chips, medium density, made with high waterproof resin binders of grade to suit application; sanded faces.

B. Fiberglass Column Cover: Fiberglass reinforced polyester (FRP) molded with Class "A" fire-rated resins. Lap joint sections.

2.2 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3, GP - 50 General Purpose for horizontal surfaces and GP28. Color pattern and matte as selected.

B. Laminate Backing Sheet: 0.020 inch Backing Sheet grade, undecorated plastic laminate.

2.5 ADHESIVE

A. Adhesive: FS MMM-A-130 contact adhesive. Type recommended by laminate manufacturer to suit application.

2.6 FASTENERS

A. Fasteners: Of size and type to suit application; US32D finish in concealed locations and same finish in exposed locations.

B. Concealed Joint Fasteners: Threaded steel.

2.7 ACCESSORIES

A. Lumber for Shimming, Blocking, and Birch: Softwood lumber of Douglas species.

B. Plastic Edge Trim: Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness; color as selected.

C. Primer: Alkyd primer sealer type.

D. Wood Filler: Solvent base, tinted to match surface finish color.

2.8 WOOD TREATMENT PROCESSES

A. Wood Preservative by Pressure Treatment (PT Type): AWPA Treatment C2 using water borne preservative with 0.25 percent retainage.

2.9 SHOP TREATMENT OF WOOD MATERIALS

A. Shop pressure treat treatment to wood materials requiring preservatives to concealed wood blocking.

B. Redry wood after pressure treatment to maximum 6-10 percent moisture content.

2.10 HARDWARE

A. Hardware: BMHA A 156.9 as follows:
   1. Hinges: Euro-style hinge with concealed knuckle; 170 degrees swing with self closing capability at less than 90 degrees to its closed position; clip concealed hinge shall pass Section 4.2; 4.3 (hinge operating life test) and 4.3 (Self Closing Hinge Test) of ANSI/BHMA A 156.9. Hinges to be nickel plated.

   2. Pulls: Wire pulls with center to center dimension of 3-1/2 inches, outer dimension of 5/16 inches in diameter, and a projection of 1-5/16 inches. The wire pulls shall be stainless steel in a US32D finish.

   3. Latches are not required due to the type of hinges specified. Select latches only when seismic condition warrant their use.

   4. Shelf Standards are 5/8 inch in width and 3/16 of an inch in height. This type of standard is used where shelves are supported along the two ends. There shall be four vertical standards for support. Standards shall be recessed in the vertical walls of the casework.

Appropriate shelf supports with rubber cushion shall be used.

Where adjustable shelving is required but no end supports are used, provide steel brackets and standards for the adjustable shelving requirements. Steel brackets shall be deep enough to carry the full depth of the shelving. Finish for steel standards and brackets shall be anodized chrome.

5. Drawer slides shall have the following load capacities according to BHMA for dynamic rating of 75 lbs and static rating of 100 lbs. The slides shall have a self-close/stay-closed action, epoxy coated steel, nylon rollers, bottom corner mounting, captive RH profiles, tolerance compensating LH profiles, 1/2 inch side clearance, double warning stop with lock out position, exceeds BMHA Grade 1 requirements, and 3/4 extension drawer runners.

2.11 FABRICATION

A. Fabricate to AWI Custom standards.

B. Shop assemble work for delivery to site, permitting passage through building openings.

C. Fit exposed sheet material edges with plastic edging. Use one piece for full length only.

D. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.

G. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

2.12 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

A. Install work in accordance with AWI Custom Quality Standard.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install components with screws at 12 inch on center.

E. Install fiberglass column per manufacturer’s recommendations.

3.3 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.4 ERECTION TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07191

VAPOR RETARDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheet and sealant materials for controlling vapor diffusion.

1.2 RELATED SECTIONS

A. Section 07213 - Batt Insulation: Insulation.

B. Section 07900 - Joint Sealers: Sealants.

1.3 REFERENCES

A. ASTM C920 - Elastomeric Joint Sealants.

B. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

C. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 DEFINITION

A. Vapor Retarder: A material or assembly of materials that resists water vapor diffusion through it.

1.5 SYSTEM DESCRIPTION

A. Materials and installation methods to provide continuity of vapor retarder:
   1. In conjunction with materials described in Section 07213.
   2. To seal gaps between enclosure components and opening frames.

1.6 PERFORMANCE REQUIREMENTS

A. Maximum Vapor Permeability (Perm): 1 ng/S/m/pa measured in accordance with ASTM E96 Method E.

1.7 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data indicating material characteristics, performance criteria, limitations, and installation methods.

C. Manufacturer's Installation Instructions: Indicate preparation and installation requirements, techniques.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with SWRI - Sealant and Caulking Guide Specification requirements for materials and installation.

B. Maintain one copy of each document on site.

1.9 SEQUENCING

A. Sequence Work to permit installation of materials in conjunction with other retardant materials and seals.

B. Do not install vapor retarder until items penetrating it are in place.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Sheet Retarder Type 1 opaque or translucent laminated reinforced membrane film for above grade application, having a maximum perm rating of 1.0; manufactured by the following:

1. Aquabar "B" (30/30/30) for wall construction and Pyro Kure 600 for roof decks, both are products of fortifiber Corporation, 4489 Bandini Blvd., Los Angeles, CA 90023.

2. T-65 for wall construction are products of Griffolyn - Reef Industries, Inc., P. O. Box 750250, Houston, TX 77275-0250, Phone (800) 231-6074.

3. Rufco 300 for walls, a product of Raven Industries, P. O. Box 5107, Sioux Falls, SD 57117-5107, Phone (800) 635-3456.

2.2 SEALANTS

A. Polyurethane Sealant Type S: ASTM C920, Grade NS, Class 25, Use NT; single component, chemical curing, non-sagging; Buff color; Dymeric manufactured by Tremco:
1. Elongation Capability: 25 percent.
2. Service Temperature Range: -40 to 180 degrees F (-40 to 82 degrees C).
3. Shore A Hardness Range:20 to 35.

B. Primer: Recommended by sealant manufacturer to suit application.

C. Cleaner: Non-corrosive type; recommended by sealant manufacturer; compatible with adjacent materials.

2.3 ADHESIVES

A. Mastic Adhesive or Tape: Non-solvent type, compatible with sheet barrier and substrate, thick mastic of uniform consistency.

2.4 ACCESSORIES

A. Thinner and Cleaner for Neoprene Sheet: As recommended by sheet material manufacturer.

B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide, compatible with sheet material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify condition of substrate and adjacent materials.

3.2 PREPARATION

A. Remove loose or foreign matter which might impair adhesion.

B. Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturers' instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Vapor Retarder For Stud Framed Walls: Secure sheet barrier Type 1 to stud faces with adhesive. Lap edges over stud faces, lap ends onto adjacent construction; tape ends with non-solvent adhesive to ensure complete seal.

C. Vapor Retarder Seal For Openings: Install sheet barrier Type 1 between window and door frames and adjacent vapor retarder and seal with adhesive. Position laps over firm bearing.

D. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.

END OF SECTION

SECTION 07212

BOARD INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation at furred wall construction.

1.2 RELATED SECTIONS

A. Section 04320 - Veneer Masonry System.

B. Section 07213 - Batt Insulation.

C. Section 07531 - EPDM Single-Ply Membrane Roofing System: Rigid insulation at roof system.

1.3 REFERENCES

A. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.

B. ASTM C1013 - Membrane Faced Rigid Cellular Polyurethane Roof Insulation.

C. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

D. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

F. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.

G. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

H. FS: Federal Specifications - HH-I-1972/1 - Insulation Board Thermal Polyurethane or Polyisocyanurate, faced with aluminum foil on both sides of the foam.

1.4 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials in Section 07416.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Data: Provide data on product characteristics, performance criteria, and limitations.

B. Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation, and installation techniques.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Sample: 4" x 4" x 1" thick; two pieces.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation. Follow manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

A. Celotex Corp. Product Thermax 610C.

B. Amoco Foam Product Amofoam - CM

C. Dow Chemical, U.S.A. Product Styrofoam High Load 115

2.2 INSULATION MATERIALS

A. CAVITY WALL INSULATION

Polyisocyanurate Insulation: Closed cell glass fiber reinforced type, conforming to the following:

1. Board Size: 16 x 96 inch.
2. Board Thickness: 2 inches.
3. Facing: Reflective aluminum foil facers.
4. Thermal Resistance: Aged (conditioned R-value as determined by ASTM C 236)R of 7.0 per 1-inch thickness at 75 degree mean temperature.
5. Board Edges: square.
6. Water Absorption: In accordance with ASTM D2842 less than 1 1/2 percent by volume maximum.
7. Flame/Smoke Properties: 20/65 in accordance with UL 723.
9. Having no HCFC's in this product.
8. To be used in the metal stud furred walls.

2.3 MANUFACTURERS - ADHESIVES

A. Amoco Foam Products

B. Celotex Corporation

C. Dow Chemical, U.S.A

2.4 ADHESIVES

A. Adhesive Type 1: Type recommended by insulation manufacturer for application.

2.5 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch.

B. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be mechanically fastened to surface to receive board insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place; as recommended by the manufacturer of the insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

B. Verify substrate surface is flat, free of honeycomb, fins, irregularities, materials or substances that may impede adhesive bond.

3.2 INSTALLATION - CAVITY WALLS

A. Secure impale fasteners to substrate at a frequency of 6 per insulation board.

B. Apply required adhesive in three continuous beads per board length to full bed 1/8 inch thick on substrate. Daub adhesive tight to protrusions to ensure continuity of vapor retarder and air seal.

C. Install boards horizontally between wall reinforcement vertically.

D. Place membrane surface against adhesive. Tape seal board joints.

E. Place boards in a method to maximize contact bedding. Stagger side joints. Butt edges and ends tight to adjacent board and no protrusions. Place impale fastener locking

discs.

F. Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

3.3 PROTECTION OF FINISHED WORK

A. Do not permit work to be damaged prior to covering insulation.

END OF SECTION

SECTION 07213

BATT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Batt insulation in interior wall construction.

B. Batt insulation in ceilings.

1.2 RELATED SECTIONS

A. Section 05400 - Cold Formed Metal Framing: Supporting construction.

B. Section 07212 - Board Insulation.

C. Section 09260 - Gypsum Board Systems: Acoustical Insulation.

1.3 REFERENCES

A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

B. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

C. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.

D. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.4 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier above acoustical ceiling, and in conjunction with thermal insulating materials in Section 07212.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Data: Provide data on product characteristics, performance criteria, and limitations.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

A.	Certainteed Corporation	Product Bldg Insulation
B.	Manville	Product C.I. Unfaced
C.	Owens/Corning Fiberglas	Product Thermal Batts

2.2 MATERIALS

A. Batt Insulation:

1. Faced batt insulation:

a. ASTM C665 preformed glass fiber batt; friction fit, conforming to the following:
b. Thermal Resistance: R of 3.7 per 1-inch thickness.
c. Batt size: 16" W x 96" H x 3 ½" D.
d. Facing: Foil - reinforced-kraft facing.
e. Flame/Smoke: 75/150.

2. Unfaced Sound Attenuation Batt Insulation:

a. ASTM C665, Type 1 glass fiber batt; friction fit, conforming to the following:
b. Batt size: 16" W x 96" H x 3 ½" D.
c. Facing: Unfaced.
d. Flame/Smoke: 10/10.

3. Unfaced Ceiling Sound Attenuation Batt Insulation:

a. ASTM C665, Type 1 glass fiber batt; friction fit, conforming to the following:
b. Thermal Resistance: R of 11 (3 ½" thick)
c. Batt size: 24" W x 48" H x 3 ½" D.
d. Facing/Foil: Unfaced.
e. Flame/Smoke: 10/10.

B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide.

C. Insulation Fasteners: Steel impale spindle and clip on flat metal base, self adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install above acoustical ceiling without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

END OF SECTION

SECTION 07270

FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. ASTM E 84 - Surface Burning Characteristics of Building Materials

B. ASTM E 814 - Fire Tests of Through-Penetration Fire Stops

C. UL-05 - Fire Resistance Directory

D. UL 723 - Test for Surface Burning Characteristics of Building Materials

E. UL 1479 - Fire Tests of Through-Penetration Firestops

1.2 SUBMITTALS: Submit under provisions in Section 01300.

A. Drawings: Detail drawings including manufacturer's descriptive data, typical details, installation instructions and the fire-test data and/or report as appropriate for the fire resistance rated construction and location. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations are to receive firestopping, drawings shall indicate location and type of application.

B. Certificates: Certificates attesting that firestopping material complies with the specified requirements. The label or listing of the Underwriters Laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing methods.

1.3G ENERAL REQUIREMENTS

A. Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and

gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

1.4 STORAGE AND DELIVERY

A. Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSPECTION

A. A representative of the manufacturer shall be on the site during the initial firestopping applications and periodically during the application period to ensure that preparations are adequate, that surfaces are clean and suitable for application, and that materials are applied according to the manufacturer's recommendations and the contract requirements.

1.6 INSTALLER QUALIFICATIONS

A. Each installer of firestopping material shall be trained and have a minimum of 3 years experience in the installation of firestopping of the type specified.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

A. Fire Hazard Classification: Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL-05.

B. Toxicity: Material shall be nontoxic to humans at all stages of application.

C. Fire Resistance Rating: Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

1. Through-Penetrations: Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479, except that T Ratings are not required for penetrations smaller than or equal to a 4 inch nominal pipe or 16 square inches in overall cross sectional area. Fire resistance ratings shall be the following:

a)Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = 2 hour, T Rating = 2 hour.

b)Penetrations of Fire Resistance Rated Floors and Ceiling-Floor Assemblies; F Rating = 2 hour, T Rating = 2 hour.

2. Construction Joints and Gaps: Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur.

PART 3 EXECUTION

3.1 PREPARATION

A. Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system.

3.2 INSTALLATION

A. Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Firestopping shall be provided in the following locations, except in floor slabs on grade:

a) Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance

rated walls, partitions, and ceiling-floor assemblies.

b) Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c) Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d) Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e) Construction joints in floors and fire rated walls and partitions.

f) Other locations where required to maintain fire resistance rating of the construction.

3.3 INSPECTION

A. Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

END OF SECTION

SECTION 07531

ELASTOMERIC SHEET ROOFING - FULLY ADHERED - CONVENTIONAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheathing over metal deck surface and vapor retarder.

B. Insulation, membrane roofing, base flashings, roofing membrane expansion joints, high density fiberboard and counter flashing.

1.2 RELATED SECTIONS

A. Section 05311 - Steel Roof Deck: Roof deck substrate.

B. Section 06114 - Wood Blocking and Curbing: Wood nailers.

C. Section 07620 - Sheet Metal Flashing and Trim: Counter flashing and reglet.

D. Section 07710 - Manufactured Roof Specialties: Counter flashing and Coping.

E. Section 07724 - Roof Hatches: Counter flashing and integral support curbs.

F. Section 15430 - Plumbing Specialties: Roof drains, hoppers and sumps.

G. Section 16670 - Lighting: Lightning protection.

1.3 REFERENCES

A. ANSI/ASTM C707 - Gypsum Board Substrate for Floor or Roof Assemblies.

B. ASTM C177 - Test Method for Steady-State thermal Transmission Properties by Means of the Guarded Hot Plate.

C. ANSI/ASTM D412 - Rubber Properties in Tension.

D. ANSI/ASTM D746 - Brittleness Temperature of Plastics and Elastomeric by Impact.

E. ASTM D624 - Rubber Property - Tear Resistance.

F. ASTM D822 - Practice for Operating Light and Water-Exposure Apparatus (Carbon-Arc) Type for Testing Paint, Varnish, Lacquer, and Related Products.

G. ASTM D1004 - Initial Tear Resistance of Plastic Film and Sheeting.

H. ASTM D2240 - Rubber Property - Durometer Hardness.

I. ASTM E96 - Water Vapor Transmission of Materials.

J. Factory Mutual Engineering & Research Corporation (FM) - Roof Assembly Classifications.

K. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.

L. Underwriters Laboratories (UL) - Fire Hazard Classifications.

1.4 SYSTEM DESCRIPTION

A. Class A Elastomeric Sheet Membrane Conventional Roofing System: One ply membrane system with insulation and adhesive applied membrane finish.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate setting plan for tapered insulation, joint or termination detail conditions, conditions of interface with other materials.

B. Product Data: Provide characteristics on membrane materials, flashing materials, insulation.

C. Samples: Submit two 16 x 16 inch in size illustrating insulation.

D. Manufacturer's Installation Instructions: Indicate special precautions required for seaming the membrane.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Reports: Indicate procedures followed; ambient temperatures, humidity, wind velocity during application.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with five years documented experience.

B. Applicator: Company specializing in performing the work of this section with six years documented experience and approved by system manufacturer.

C. Work of this section to conform to manufacturer's instructions.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements as stated hereinafter for roof assembly fire hazard requirements.

B. Underwriters Laboratories, Inc. (UL): Class A Fire Hazard Classification.

C. Factory Mutual Engineering & Research Corporation (FM): Roof Assembly Classification, of Class 1 Construction, wind uplift requirement of I90, in accordance with FM Construction Bulletin 1-28.

1.8 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this section. See Division 1 for additional directions.

B. Review installation procedures and coordination required with related Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for roof covering shall provide good air circulation and protection from surface staining.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing membrane during high wind, inclement weather, ambient temperatures below 10 degrees F or within 5 degrees of the dew point.

B. Do not apply roofing membrane to damp or frozen deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 COORDINATION

A. Coordinate the work with the installation of associated metal flashings, as the work of this section proceeds.

1.12 WARRANTY

A. Furnish manufacturer's warranty for 20 years to provide for repairs or replacement of the complete roofing system, including insulation, roof membrane, and metal fascia at perimeter, if deterioration is caused by defects in materials or workmanship at no cost to the Government.

PART 2 PRODUCTS

2.1 MANUFACTURERS - MEMBRANE MATERIAL

A. Acceptable Manufacturers

1. Carlisle Syntec Systems
   Carlisle, PA 17013
   (717) 245-7000, Mr. C. Kuhl

2. ER System
   2950 Niagara Lane
   Plymouth, MN 55447
   (800)403-7747, Mr. J. Leonard

3. Firestone Building Products Co.
   525 Congressional Blvd.
   Carmel, IN 46032
   (800) 428-4442

4. GenFlex Roofing System,
   Gen Corp Polymer Products
   1722 Indian Wood Circle
   Maumwee, OH 43537-0673
   (800) 443-4272

5. Manville Roofing System,
   A Division of Shuller
   International, Inc.
   Fort Worth, TX 76147-2069
   (800) 972-1081

2.2 MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: 60 mil EPDM, black color conforming to ASTM D4637 Type I Class U or SR and the following criteria:

Properties:	Test:	Results:
Tensile Strength:	ANSI/ASTM D412	1780 min,psi (MPa)
Elongation:	ANSI/ASTM D412	495 Ultimate,min,%
Hardness - Shore A:	ASTM D2240	
Tear Strength:	ASTM D624	215(37.6)min,lb.f/ in (kn/m)
Resistance To Water Absorption: After 7 days immersion @ 158 deg F, Changes in mass, max %	ASTM D471	
Water Vapor Perms: $\frac{}{2}$	ASTM E96	2.0
Resistance To Outdoor (Ultraviolet) Weathering	ASTM G26	No Cracks
Brittleness Temp, max, deg. F (deg C)	ASTM D746	-85 (-65)

B. Seaming Materials: As recommended by membrane manufacturer.

2.3 ADHESIVE MATERIALS

A. Surface Conditioner: type, compatible with membrane.

B. Membrane Adhesives: As recommended by membrane manufacturer.

C. Insulation Adhesive: As recommended by insulation manufacturer.

D. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

2.4 SUBSTRATE COVERING MATERIALS

A. One inch thick high density fiberboard of 2.5 R value shall be placed and attached over the insulation prior to the installation of the 60 mil E.P.D.M. membrane. The high density fiberboard shall be approved by the membrane manufacturer.

2.5 INSULATION (ROOF)

A. General: Provide performed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.

1. Provide preformed, tapered insulation boards where indicated for sloping to drain. Fabricate with the following taper:

a) 1/4 inch per 12 inches (1:48), unless otherwise indicated.
b) As indicated on Drawings.

B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurte thermal insulation with core formed by using HCFCs as blowing agents to comply with ASTM C 1289, classified by facer type as follows:

1. Face Type: Type II, felt or glass-fiber mat on both major surfaces.

C. Nails and Fasteners

Nails and fasteners shall conform to the following requirements:

1. Nails for Fastening Insulation to Flush Mounted Wood Nailers

FS FF-N-105, Type II, Style 20, of sufficient length to hold insulation securely in place.

2. Fasteners
Insulation manufacturer's recommendations except holding power when driven, shall be not less than 120 pounds each in steel deck.

D. Wood Nailers

Wood nailers shall conform to Section 06114 WOOD BLOCKING AND CURBING including preservative treatment. Edge nailers shall be not less than nominal 6 inches wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal 3 inches wide by the full thickness of the insulation.

2.6 FLASHINGS

A. Flexible Flashings: Same material as membrane EPDM; conforming to the following:

1. Thickness: .060 mil.
2. Maximum Perm Rate: 2.0
3. Tensile Strength: 1305 psi.
4. Elasticity: 50 percent with full recovery without set.
5. Color: black.

B. Counter Flashings: Prefinished metal, as specified in Section 07620.

C. Prefabricated Roof Specialties: As specified in Section

07710.

2.7 ACCESSORIES

A. Sheathing Joint Tape: Paper type.

B. Insulation Joint Tape: Asphalt treated glass fiber reinforced; 6 inches wide; self adhering.

C. Roofing Nails: Galvanized, hot dipped or non-ferrous type, size as required to suit application.

D. Insulation Fasteners: Appropriate for purpose intended and approved by Factory Mutual and] system manufacturer; length required for thickness of material with metal washers as recommended by insulation manufacturer.

E. Sealants: As recommended by membrane manufacturer.

F. Strip Reglet Devices: Galvanized steel; maximum possible lengths per location, with attachment flanges.

G. Walkway Pads: Rubberized units, 30 inches square in size, textured finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

D. Verify deck surfaces are dry and free of snow or ice. Confirm dry deck by moisture meter with 12 percent moisture maximum.

E. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood cant strips wood nailing strips and reglets are in place.

3.2 PREPARATION - CONCRETE DECK

A. Fill surface honeycomb and variations with latex filler.

3.3 VAPOR RETARDER APPLICATION

A. Apply vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.

B. Extend vapor retarder under cant strips and blocking to deck edge.

3.4 INSULATION APPLICATION

A. Ensure vapor retarder is clean and dry.

B. Apply adhesive to the top surface of the first layer of insulation. Embed the second layer of insulation into adhesive, with joints staggered minimum 6 inch from joints of first layer.

C. Place the constant thickness first layer and the tapered thickness insulation second layer to the required slope pattern in accordance with manufacturer's instructions.

D. Maximum Total Insulation Thickness is 4 inches and the minimum insulation R-value is as previously noted.

E. Place boards perpendicular to deck flutes with edges over flute surface for bearing support.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. Lay tapered boards for a distance of 24 inches back from roof drains for positive drainage.

H. Apply no more insulation than can be covered with membrane in same day.

I. Tape joints of insulation in accordance with insulation manufacturer's instructions.

3.5 MEMBRANE APPLICATION

A. Apply membrane in accordance with manufacturer's instructions.

B. Apply adhesive at a rate in accordance with manufacturer's instructions.

C. Roll out membrane, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.

D. Bond sheet to substrate except those areas directly over or

within 3 inches of a control or expansion joint.

E. Overlap edges and ends and seal by manufacturer's splice adhesive minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

F. Shingle joints on sloped substrate in direction of drainage Apply joint tape and seal.

G. Extend membrane up minimum of 8 inches onto vertical surfaces.

H. Seal membrane around roof penetrations.

3.6 FLASHINGS AND ACCESSORIES

A. Apply flexible flashings to seal membrane to vertical elements.

B. Secure to nailing strips at 4 inches o.c. and reglets.

C. Coordinate installation of roof drains, sumps and related flashings.

D. Seal flashings and flanges of items penetrating membrane.

3.7 CLEANING

A. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

B. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.8 PROTECTION

A. Protect building surfaces against damage from roofing work.

B. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reglets, pitch pockets, sill, and lintel, flashings.

B. Counterflashings over bituminous, or EPDM base flashings.

C. Spring type Flashing System, a manufactured product.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 04320 - Veneer Masonry: Placement of flashing reglets and accessories.

1.3 RELATED SECTIONS

A. Section 06114 - Wood Blocking and Curbing: Wood blocking for metal roofing substrate profiles.

B. Section 07900 - Joint Sealers.

C. Section 06114 - Wood Blocking and Curbing: Roof curbs for mechanical equipment.

1.4 REFERENCES

A. ASTM B209 - Aluminum and Alloy Sheet and Plate.

B. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

C. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.

D. NRCA (National Roofing Contractors Association) - Roofing Manual.

E. SMACNA - Architectural Sheet Metal Manual.

F. FS QQ-L-201 - (Rev. F; AM2) Lead Sheet, Grade Cor D, hard, containing not less than 4 percent

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

B. Samples: Submit two samples, 8 x 8 inch in size illustrating typical seam, external corner, internal corner, junction to vertical dissimilar surface, material and finish and metal finish color.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA NRCA standard details and requirements.

1.7 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal flashing work with six years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, weathertight, ventilated areas until immediately before installation.

B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials which may cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Aluminum Sheet: ASTM B209, alloy, temper; 0.050 inch thick; plain finish, shop pre-coated with polyvinylidene fluoride (PVF2) conforming to AAMA 605.2 coating. Color as selected by Architect.

2.2 ACCESSORIES

A. Fasteners: Aluminum Same material and finish as the sheet metal, with soft neoprene washers.

B. Primer: Zinc chromate.

C. Protective Backing Paint: Zinc chromate alkyd.

D. Sealant: Polyurethane type, specified in Section 07900.

E. Bedding Compound: Rubber-asphalt.

F. Plastic Cement: ASTM D4586, Type I.

2.3 COMPONENTS

A. Gravel Stop: Per SMACNA Plate 39 Fig. A.

2.4 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, minimum 0.50 inches thick and continuous in width, interlockable with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with standing seams.

F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

H. Fabricate flashings to allow toe to extend 2 inches over roofing material. Return and brake edges.

2.5 FINISH

A. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.3 INSTALLATION

A. Conform to drawing details.

B. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

C. Secure flashings in place using concealed fasteners.

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

G. Seal metal joints watertight.

H. Use 50/50 solder and neutralize flux after soldering lead.

3.4 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparing substrate surfaces.

B. Sealant and joint backing.

1.2 RELATED SECTIONS

A. Section 04311 - Concrete Masonry Units: Sealant required in conjunction with control joints in concrete masonry unit walls.

B. Section 04320 - Veneer Masonry System: Sealants required in conjunction with brick masonry.

C. Section 07531 - Elastomeric Sheet Roofing - Fully Adhered - Conventional: Sealants required in conjunction with roofing.

D. Section 07620 - Sheet Metal Flashing and Trim: Sealants required in conjunction with metal flashings.

E. Section 08520 - Aluminum Windows: Sealants required in conjunction with aluminum windows.

F. Section 08800 - Glazing: Sealants required in conjunction with glazing methods.

1.3 REFERENCES

A. ASTM C790 - Use of Latex Sealing Compounds.

B. ASTM C804 - Use of Solvent-Release Type Sealants.

C. ASTM C834 - Latex Sealing Compounds.

D. ASTM C919 - Use of Sealants in Acoustical Applications.

E. ASTM C920 - Elastomeric Joint Sealants.

F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

G. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

B. Samples: Submit two samples, 2 x 2 inch in size illustrating sealant colors for selection.

C. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform acoustical sealant application work in accordance with ASTM C919.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum five years documented experience approved by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 WARRANTY

A. Provide a five year warranty.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 SEALANTS

A. Acrylic Emulsion Latex for interior use only (Type C): ASTM C834, single component; white color; manufactured by one of the following: Pecora Corp - "AC-20"; Sonolac" - Sonneborn Building Prod. Div., Chem Rex, Inc., "Temco Acrylic Latex 834" - Tremco.

B. Polyurethane Sealant (Type S): ASTM C920, Grade NS, Class 25, Use M,G,A; single component, chemical curing, non-staining, non-bleeding, non-sagging type; Mameco, Pecora Corp., Peterson, Harry S. PRC, Sika Corp., color as selected; manufactured by Tremco.
1. Elongation Capability 25 percent
2. Service Temperature Range -40 to 180 degrees F
3. Shore A Hardness Range 20 to 35

C. Silicone Sealant (Type S): ASTM C920, Grade NS, Class 25, Use NT,M,G,A single component, chemical curing, non-sagging, non-staining, non-bleeding; Dow Corning; GE, Mobay Corp., color as selected; manufactured by Pecora Corp.
1. Elongation Capability 50 percent
2. Service Temperature Range -35 to 160 degrees F
3. Shore A Hardness Range 30

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.

B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

END OF SECTION

SECTION 08111

STANDARD STEEL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-rated and fire rated steel doors.

B. Louvers.

C. Metal transom panels to match the metal door construction.

1.2 RELATED SECTIONS

A. Section 04340 - Reinforced Unit Masonry System: Masonry mortar fill of metal frames.

B. Section 08112 - Standard Steel Frames.

C. Section 08211 - Flush Wood Doors.

D. Section 08712 - Door Hardware.

E. Section 08800 - Glazing: Glass for doors.

F. Section 10200 - Louvers: Louvers for doors.

G. Section 09900 - Painting: Field painting of doors.

1.3 REFERENCES

A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

B. ANSI/SDI-100 - Standard Steel Doors and Frames.

C. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. ASTM E152 - Methods of Fire Tests of Door Assemblies.

E. Door Hardware Institute (DHI) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

F. NFPA 80 - Fire Doors and Windows.

G. NFPA 252 - Fire Tests for Door Assemblies.

H. UL 10B - Fire Tests of Door Assemblies.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers, and finish.

B. Product Data: Indicate door configurations, location of cut-outs for hardware reinforcement.

C. Manufacturer's Installation Instructions: Indicate special installation instructions.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Fire Rated Door Construction: Conform to ASTM E152.

B. Fire Rated Door Construction: Rate of rise of 250 F degrees across door thickness.

C. Installed Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Doors shall be stored in an upright position. Whenever damage becomes evident, abraded, scarred, or rusty areas shall be cleaned and touched up with the paint used for the shop painting.

B. Protect doors with resilient packaging sealed with heat shrunk plastic.

C. Break seal on-site to permit ventilation.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 DOOR MANUFACTURERS

A. Fenestra Corporation

B. Republic Builders Products

C. Steelcraft Manufacturing Company

2.2 DOORS

Grade II - Heavy-duty 1-3/4 inches (Level B): Interior Doors
Model 3 - Seamless - Hollow Steel Construction

Grade III - Extra heavy-duty 1-3/4 inches (Level A): Exterior Doors
Model 4 - Seamless - Composite Construction

A. Exterior Doors (Thermally Broken): SDI-100 Grade III Model 4. Minimum gauge for face metal sheet shall be 14 gauge.

B. Interior Doors (Non-rated): SDI-100 Grade II Model 3 or 4. Face metal for interior doors shall be 18 gauge.

C. Interior Doors (Fire Rated): SDI-100 Grade II Model 3 or 4. Face metal for interior fire-rated doors shall be 18 gauge.

2.3 DOOR CONSTRUCTION

A. Face: Steel sheet in accordance with ANSI/SDI-100.

B. Core: Cardboard honeycomb steel channel grid vertical steel stiffeners.

2.4 ACCESSORIES

A. Louvers:

1. Material and Finish: Roll formed steel; pre-painted finish to color as selected. Wipe coat of zinc.
2. Louver Blade: Inverted V blade, sight proof.
3. Louver Free Area: 50 percent.
4. Frame: flush style with surface tamper proof fasteners.

B. Removable Stops: Rolled steel shape, butted corners; prepared for countersink style tamper proof screws.

C. Primer: Zinc chromate type.

2.5 FABRICATION

A. Astragals for Double Doors: Steel, Z shaped, specifically for double doors.

B. Fabricate doors with hardware reinforcement welded in place.

C. Attach fire rated label to each door unit.

D. Close top and bottom edge of exterior doors with inverted steel channel closure. Seal joints watertight.

E. Configure exterior doors with special profile to receive recessed weatherstripping.

2.6 FINISH

A. Steel Sheet: Galvanized to ASTM A525 G60.

B. Primer: Air dried.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install doors in accordance with ANSI/SDI-100 and DHI.

B. Coordinate installation of glass and glazing.

C. Install door louvers, plumb and level.

D. Coordinate installation of doors with installation of frames specified in Section 08112 and hardware specified in Section 08710.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08112

STANDARD STEEL FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-rated, fire rated steel frames.

B. Interior glazed light frames.

1.2 RELATED SECTIONS

A. Section 04340 - Reinforced Unit Masonry System: Masonry mortar fill of metal frames.

B. Section 08111 - Standard Steel Doors.

C. Section 08211 - Wood Doors.

D. Section 08712 - Door Hardware.

E. Section 08800 - Glazing.

F. Section 09900 - Painting: Field painting of frames.

1.3 REFERENCES

A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

B. ANSI/SDI-100 - Standard Steel Doors and Frames.

C. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. ASTM E152 - Methods of Fire Tests of Door Assemblies.

E. DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

F. NFPA 80 - Fire Doors and Windows.

G. NFPA 252 - Fire Tests for Door Assemblies.

H. UL 10B - Fire Tests of Door Assemblies.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate frame elevations, reinforcement, and finish.

B. Product Data: Indicate frame configuration, anchor types and spacings, location of cut-outs for hardware, reinforcement.

C. Samples: Submit two carrier samples of frame, 12 x 12 inch in size illustrating construction of frame and surface texture.

D. Manufacturer's Installation Instructions: Indicate special installation instructions.

E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Fire Rated Frame Construction: Conform to ASTM E152.

B. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

1.8 DELIVERY, STORAGE, AND HANDLING

A. To provide protection during shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or provided with temporary steel spreaders at the bottom of each frame. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting good air circulation. Assembled frames shall be stored in an upright position. Whenever damage becomes evident, abraded, scarred, or rusty areas shall be cleaned and touched up with the paint used for the shop painting.

B. Accept frames on site in manufacturer's packaging. Inspect for damage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 FRAME MANUFACTURERS

A. Fenestra Corporation

B. Republic Builders Products

C. Steelcraft Manufacturing Company

2.2 FRAMES

A. Exterior Frames: 14 gage thick material, base metal thickness.

B. Interior Frames: 16 gage thick material, base metal thickness.

2.3 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole.

B. Removable Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper proof screws.

C. Bituminous Coating: Fibered asphalt emulsion.

D. Primer: Zinc chromate type.

2.4 FABRICATION

A. Fabricate frames as welded unit.

B. Mullions for Double Doors: Fixed type, of same profiles as jambs.

C. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.

D. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

E. Prepare frame for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.

F. Configure exterior frames with special profile to receive recessed weatherstripping.

G. Fabricate frames to suit masonry wall coursing with 4 inch head member.

2.5 FINISH

A. Steel Sheet: Galvanized to ASTM A525 G60.

B. Primer: Air dried.

C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install frames in accordance with ANSI/SDI-100 and DHI.

B. Coordinate with masonry and wallboard wall construction for anchor placement.

C. Coordinate installation of glass and glazing.

D. Coordinate installation of frames with installation of hardware specified in Section 08710 and doors in Section 08111.

E. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

END OF SECTION

SECTION 08211

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid flush wood doors; flush and flush glazed configuration.

1.2 RELATED SECTIONS

A. Section 08112 - Standard Steel Frames: Steel door frames.

B. Section 08712 - Door Hardware.

C. Section 08800 - Glazing.

D. Section 09900 - Painting: Site finishing doors.

E. Section 10255 - Door Louvers: Metal louvers.

1.3 REFERENCES

A. ANSI A135.4 - Basic Hardboard.

B. ASTM E90 - Measurement of Airborne Sound Transmission Loss of Building Partitions.

C. ASTM E413 - Classification for Determination of Sound Transmission Class.

D. AWI - Quality Standards of the Architectural Woodwork Institute.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, special blocking for hardware, identify cutouts for glazing and louvers.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics; factory machining criteria.

C. Samples:

1. Submit two samples of door construction, 12 x 12 inch in size cut from top corner of door.

D. Manufacturer's Installation Instructions: Indicate

special installation instructions.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with AWI Quality Standard Section 1300, Premium Grade.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of General Requirements.

B. Package, deliver and store doors in accordance with AWI Section 1300.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION

A. Coordinate work under provisions of General Requirements.

B. Coordinate the work with door opening construction, door frame and door hardware installation.

1.10 WARRANTY

A. Provide the following warranty to the following terms:

1. Life of Installation: Interior doors.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Algoma/Hardwoods, Algoma, WI, Ph 800-678-8910: Product - Architectural Wood Flush Door

B. Eggers Industries, Two Rivers, WI ph 414-793-1351: Product Architectural Wood Flush Door

C. Weyerhaeuser Architectural Door Div., Marshfield, WI ph 800-869-3667: Product - Architectural Wood Flush Door

2.2 DOOR TYPES

A. Flush Interior Doors: 1-3/4 inches thick; solid core construction, acoustic rated and fire-rated as indicated.

2.3 DOOR CONSTRUCTION

A. Core Solid, Non-Rated: AWI Section 1300, Type PC5-Particleboard.

B. Core (Solid, Special Function): AWI Section 1300, Type SR - Sound Retardant (Acoustical)

C. Core (Solid, Fire Rated): AWI Section 01300, FIRE RATED.

2.4 FLUSH DOOR FACING

A. Veneer Facing (Flush Interior Doors): AWI Custom quality species wood, rotary cut, birth with MDO (medium density overlay) for stain finish.

B. Stain with medium cherry stain.

2.5 ADHESIVE

A. Facing Adhesive: Type II - water resistant.

2.6 ACCESSORIES

A. Metal Louvers: Specified in Section 10255.

B. Glazing Stops: Wood, of same species as door facing shape, mitered corners; prepared for countersink style tamper proof screws.

2.7 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.

B. Sound Rating For Single Door Leaf and Frame Assembly: ASTM E413, minimum STC 35.

C. Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.

D. Vertical Exposed Edge of Stiles: Of same species as veneer facing for paint finish.

E. Fit door edge trim to edge of stiles after applying veneer facing.

F. Bond edge banding to cores.

G. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through bolted hardware.

H. Factory pre-fit doors for frame opening dimensions identified on shop drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

B. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install non-rated doors in accordance with AWI Quality Standards requirements.

B. Trim non-rated door width by cutting equally on both jamb edges.

C. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).

D. Pilot drill screw and bolt holes. Use threaded through bolts for half surface hinges.

E. Machine cut for hardware. Core for handsets and cylinders.

F. Coordinate installation of doors with installation of frames specified in Section 08112 and hardware specified in Section 08710.

G. Coordinate installation of glass and glazing.

H. Install door louvers, plumb and level.

3.3 INSTALLATION TOLERANCES

A. Conform to AWI requirements for fit and clearance tolerances.

B. Conform to AWI Section 1300 requirements for maximum, vertical, width, and diagonal distortion.

3.4 ADJUSTING

A. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08305

ACCESS DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of access doors:

1. Fire-rated wall access doors.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Door Hardware" for mortise or rim cylinder locks.
2. Division 9 Section "Gypsum Board Assemblies" for gypsum board walls and ceilings.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).

1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

C. Shop drawings showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.

D. Samples, 3-inch by 5-inch minimum size, of each panel face material showing factory-finished color and texture.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Test Method for Vertical Installations: ASTM E 152.
2. Test Method for Horizontal Installations: ASTM E 119.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Acudor Products Inc.
2. Bar-Co, Inc. Div., Alfab, Inc.
3. Cesco Products.
4. Elmdor Manufacturing Co.
5. J.L. Industries.
6. Karp Associates, Inc.
7. Larsen's Manufacturing Co.
8. Milcor, Inc.
9. Nystrom, Inc.
10. The Williams Bros. Corporation of America.

2.2 MATERIALS

A. Steel Sheet: ASTM A 366 (ASTM A 366M) commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.

B. Zinc-Coated Steel Sheet: ASTM A 591 (ASTM A 591M), Electrolytic zinc-coated steel sheet with Class C coating and phosphate treatment to prepare surface for painting.

C. Stainless-Steel Sheet: ASTM A 167, Type 304 with No. 4 finish according to ASTM A 480 (ASTM A 480M).

2.3 ACCESS DOORS

A. Insulated, Fire-Rated Access Doors: Self-latching units consisting of frame, trim, door, insulation, and hardware, including automatic closer, interior latch release, and complying with the following requirements:

1. Frame with Exposed Trim: Perimeter frame with integral exposed trim complying with the following requirements:

   a. Metal: 0.0625-inch- (1.59-mm-) thick stainless-steel sheet.
   b. Trim: 1-inch (25.4-mm) flange overlapping surfaces surrounding door frame.

2. Door: 0.0375-inch- (0.95-mm-) thick stainless-steel sheet, welded pan type.
3. Hinges: Continuous type.
4. Latches: Bolt type, operated by either a ring turn or flush key device (keyed alike).
5. Insulation: 2-inch- (50.8-mm-) thick mineral-fiber insulation.
6. Fire-Protection Rating for Walls: 1-1/2 hours.

2.4 FABRICATION

A. General: Manufacture each access door assembly as an integral unit ready for installation.

B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flange: Nominal 1 to 1-1/2 inches (25.4 to 38.1 mm) wide around perimeter of frame.
2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.

C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.

1. For cylinder lock, furnish 2 keys per lock and key all

locks alike.

2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for installing access doors.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.

C. Install concealed-frame access doors flush with adjacent finish surfaces.

3.3 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08410

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum doors and frames.

B. Vision glass infill panels.

C. Door hardware.

D. Perimeter sealant.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 05500 - Metal Fabrication: Placement of structural supporting anchors.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 08712 - Door Hardware: Hardware items other than specified in this section.

1.4 RELATED SECTIONS

A. Section 04320 - Veneer Masonry System: Preparation of adjacent work to receive work of this section.

B. Section 09260 - Gypsum Board System: Preparation of adjacent work to receive work of this section.

C. Section 05500 - Metal Fabrications: Metal fabricated attachment devices and framed openings.

D. Section 07900 - Sealants: System perimeter sealant and back-up materials.

E. Section 08520 - Aluminum Windows: Operable sash within glazing system.

F. Section 08800 - Glazing.

1.5 REFERENCES

A. AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. AAMA - Curtain Wall Manual #10 - Care and Handling of Architectural Aluminum From Shop to Site.

C. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

D. AAMA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

E. AAMA 606.1 - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.

F. AAMA 607.1 - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

G. AAMA 608.1 - Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

H. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.

I. ANSI A117.1 - Safety Standards for the Handicapped.

J. ANSI/ASTM A36 - Structural Steel.

K. ANSI/ASTM A386 - Zinc Coating (Hot Dip) on Assembled Steel Products.

L. ANSI/ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

M. ANSI/ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

N. ANSI/ASTM E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.

O. ANSI/ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

P. ANSI/ASTM E331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

Q. SSPC - Steel Structures Painting Council.

1.6 SYSTEM DESCRIPTION

A. Aluminum entrances and storefront system includes tubular aluminum sections, shop fabricated, factory pre-finished, vision glass, infill, related flashings, anchorage and attachment devices.

1.7 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with local code to a design pressure as follows:

1. Positive Pressure = 25.2 psf
2. Negative Pressure = 27.0 psf

B. Limit mullion deflection to flexure limit of glass with full recovery of glazing materials.

C. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

D. Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with AAMA 501.

E. Vapor Seal with Interior Atmospheric Pressure of 1 inch (25 mm) sp, 72 degrees F (22 degrees C), 40 Percent RH: No failure.

F. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

G. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees over a 12 hour period without causing detrimental affect to system components.

H. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

1.8 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details and manufacturer's standard color chart for the High Performance Organic coating.

C. Samples: Submit two samples of each color 4 x 4 inches in size illustrating pre-finished aluminum surface, glass units, glazing materials.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with AAMA SFM-1 and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Conform to requirements of ANSI A117.1.

1.10 QUALIFICATIONS

A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum six years documented experience.

1.11 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this Section.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum entrance and storefront components in the manufacturer's original protective packaging.

B. Store aluminum components in a clean dry location away from uncured masonry or concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.

C. Protect pre-finished aluminum surfaces with wrapping stripable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.13 ENVIRONMENTAL REQUIREMENTS

A. Do not install sealants when ambient temperature is less than 40 degrees during and 48 hours after installation.

1.14 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.15 WARRANTY

A. Provide three year warranty.

B. Warranty: Include coverage for complete system for failure to meet specified requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers offering equivalent Products.

1. Kawneer Company, Inc.
2. United States Aluminum Corp.
3. Vistawall Architectural Products

2.2 MATERIALS

A. Extruded Aluminum: ANSI/ASTM B221; 6063 alloy, T5 temper.

B. Sheet Aluminum: ANSI/ASTM B209 alloy, temper.

C. Steel Sections: ANSI/ASTM A36; shaped to suit mullion sections.

D. Fasteners: Stainless steel.

E. Shop and Touch-Up Primer for Steel Components: SSPC 15, Type 1, red oxide.

2.3 COMPONENTS

A. Frame: 2" x 4-1/2" inch nominal dimension; thermally broken with interior tubular section insulated from exterior; flush glazing stops; drainage holes; internal weep drainage system. Frames for interior glazing need not to be thermally broken.

B. Doors: 1-3/4 inches thick, 3-1/2 inch wide top rail, 3-1/2 inch wide vertical stiles, 6-1/2 inch wide bottom rail; square glazing stops.

C. Flashings: Aluminum finish as selected to match mullion sections where exposed.

2.4 SEALANT MATERIALS

A. Sealant and Backing Materials: As specified in Section 07900 of Types described below.

1. Perimeter Sealant: Type (S) Silicone.

2.5 HARDWARE

A. Hardware: As specified in Section 08710.

2.6 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to conceal from view.

E. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

2.7 FINISHES

A. General: Apply coatings either before or after fabrication as required by coating process and as required for maximum coating performance capability. Protect coating promptly after application and cure, by application of strippable film or removable adhesive cover and retain until installation has been completed.

B. Fluoropolymer Coating: Provide high performance full-strength 70% "Kynar 500" coating baked-on for 15 minutes at 450 deg. F (232 deg. C), in a dry film thickness of 1.0 mils, 30% reflective gloss (ASTM D 523), over 0.3 mil baked-on epoxy primer.

1. Durability: Provide coating which has been field tested under normal rnage of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack or check in finish, and without chalking in excess of 8 (ASTM D 659), and without fading in excess of 5 NBS units.

C. Coating thickness shall be as recommended by the manufacturer fgor high performance and as required to obtain specified warranty.

1. Color: Provide standard color as selected to match color of windows.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.2 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings.

G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Set thresholds in bed of mastic and secure.

I. Install hardware using templates provided.

J. Install glass in accordance with Section 08800, to glazing method required to achieve performance criteria.

K. Install perimeter sealant to method required to achieve performance criteria Type S, backing materials, and installation criteria in accordance with Section 07900.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in

Plane: 1/32 inch (0.8 mm).

3.4 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.5 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work from damage.

END OF SECTION

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum windows with fixed and operating sash; glass shop glazed.

B. Operating hardware and insect screens.

1.2 RELATED SECTIONS

A. Section 04320 - Veneer Masonry System: Preparation of adjacent work to receive work of this Section.

B. Section 04311 - Concrete Masonry Unit.

C. Section 04340 - Reinforced Unit Masonry System.

D. Section 05500 - Metal Fabrications: Steel lintels.

E. Section 07900 - Joint Sealers: Perimeter sealant and back-up materials.

F. Section 08410 - Aluminum Entrances and Storefronts.

G. Section 08800 - Glazing.

1.3 REFERENCES

A. AAMA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

B. ASTM A386 - Zinc Coating (Hot Dip) on Assembled Steel Products.

C. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

D. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

E. ASTM E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.

F. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

G. ASTM E331 - Test Method for Water Penetration of Exterior

Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

H. FS RR-W-365 - Wire Fabric (Insect Screening).

I. SSPC - Steel Structures Painting Manual.

1.4 SYSTEM DESCRIPTION

A. Windows: Tubular aluminum sections, shop fabricated, factory pre-finished, vision glass, related flashings, anchorage and attachment devices.

B. Configuration: Fixed non-operable and interior sliding window without screen.

C. Glazing: Interior.

1.5 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall to a design pressure as follows:

1. Positive Pressure = 28.7 psf.
2. Negative Pressure = 37.4 psf.

B. Limit member deflection to flexure limit of glass with full recovery of glazing materials.

C. System to accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing, deflection of lintel.

D. Limit air leakage through assembly to 0.35 cfm/min/sq ft (0.002 cu m/s/sq m) of wall area, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) as measured in accordance with ASTM E283.

E. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 2.86 lb/sq.ft. (136.85 N/sq.M).

F. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

G. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

1.6 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work; installation requirements; and certification.

B. Product Data: Provide component dimensions, anchorage and fasteners, glass, internal drainage details and color samples.

1. Submit two samples 4 x 6 inches (102 x 152 mm) in size illustrating window frame section mullion section screen and frame, pre-finished aluminum surfaces, glass units, glazing materials.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

D. Submit independent lab testing reports to certify that products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with AAMA 101.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing commercial aluminum windows with minimum four years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect pre-finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

1.11 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that field measurements are as instructed by the manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers offering equivalent Products.

1. EFCO Corp. Series 2900 Fixed Thermal Windows
2. Kawneer Company Inc., Series 842ST-FX.
3. Wausau Metals Corporation Product Series 3250 projected out.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper.

B. Sheet Aluminum: ASTM B209; alloy, T3 temper.

C. Fasteners: Stainless steel.

2.3 COMPONENTS

A. Frames: 3-1/2 inch wide x 4-1/4 inch deep profile, of 0.125 inch thick section; thermally broken with interior portion of frame insulated from exterior portion [applied] glass stops of [snap-on] type.

B. Sills: 2-inch thick, extruded aluminum; sloped for positive wash; fit under sash leg to 1/2 inch beyond wall face; one piece full width of opening jamb angles to terminate sill end.

C. Fasteners: Stainless steel.

D. Custom extruded sill members as detailed on drawings.

2.4 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As specified in Section 08800 of Types described below:
1. Glass in Exterior Lights: Type 1/4" gray tint in exterior pane and 1/4" clear for interior pane.

2.5 SEALANT MATERIALS

A. Sealant and Backing Materials: As specified in Section 07900 of Types described below.

B. Perimeter Sealant: Type S.

C. Sealant Used Within System (Not Used for Glazing): Type Silicone.

2.6 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to ensure concealment from view.

E. Prepare components with internal reinforcement for operating hardware.

F. Provide internal reinforcement in mullions with galvanized steel members to maintain rigidity.

G. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

H. Assemble insect screens of rolled aluminum rectangular tubular sections. Miter and reinforced frame corners. Fit mesh taught in frame into frame and secured. Fit frame with four spring loaded steel pin retainers.

I. Double weatherstrip operable units.

J. Shop glaze window units.

2.7 FINISHES

A. Exposed surfaces of all aluminum members shall be clean and free from serious surface blemishes, scratches, or tool marks. The finish shall be an organize finish applied over a five stage aluminum pretreatment. Finish shall be based on "Kynar 500" resin and be applied as a three coat, three bake system with a 1.6 mil. Minimum thickness, and shall conform to AAMA 605.2-85. The third coat shall be clear lacquer. Color shall be selected from manufacturer’s standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal

materials are ready to receive work of this Section.

3.2 INSTALLATION

A. Install window frames, glass and glazing and hardware in accordance with manufacturers instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Coordinate attachment and seal of perimeter air and vapor barrier materials.

G. Install operating hardware.

H. Install glass and infill panels in accordance with Section 08800, to glazing method required to achieve performance criteria exterior wet/dry method of glazing.

I. Install perimeter sealant to method required to achieve performance criteria Type S, backing materials, and installation criteria in accordance with Section 07900.

3.3 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

3.4 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.5 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to

remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hardware for wood, hollow steel aluminum doors.

B. Thresholds.

C. Weatherstripping, seals and door gaskets.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 08111 - Standard Steel Frames: Furnish templates for frame preparation.

B. Section 08112 - Standard Steel Doors: Furnish templates for door preparation.

C. Section 08410 - Aluminum Entrances and Storefronts: Furnish lock cylinders for installation.

1.3 RELATED SECTIONS

A. Section 08111 - Standard Steel Doors.

B. Section 08112 - Standard Steel Frames.

C. Section 08331 - Overhead Coiling Doors: Lockable coiling doors.

D. Section 08410 - Aluminum Entrances and Storefronts: Hardware for same except cylinders.

1.4 REFERENCES

A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

B. ADA: Accessibility Guidelines.

C. Local, State and Federal requirements.

D. NFPA 80 - Fire Doors and Windows.

E. AWI - Architectural Woodwork Institute - Quality Standards.

F. NFPA 252 - Fire Tests of Door Assemblies.

G. UL 10B - Fire Tests of Door Assemblies.

H. UL 305 - Panic Hardware.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate locations and mounting heights of each type of hardware.

B. Manufacturer's Data: Submit manufacturer's parts lists, templates, and maintenance instruction.

C. Samples: Submit color and finish samples.

1.6 PROJECT RECORD DOCUMENTS

A. Record actual locations of installed cylinders and their master key code.

1.7 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 QUALITY ASSURANCE

A. Perform work in accordance with the following requirements:

1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. NFPA 101.
3. NFPA 80.
4. NFPA 252.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with 10 years documented experience. approved by manufacturer.

C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

1.10 REGULATORY REQUIREMENTS

A. Conform to applicable local code for requirements applicable to fire rated doors and frames.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

C. Deliver keys to Government by security shipment direct from hardware supplier.

1.12 COORDINATION

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

1.13 WARRANTY

A. Provide five year warranty under General Provisions.

1.14 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.1 SUPPLIERS

A. Corbin & Russwin Architectural Hardware.

B. Yale Security Inc.

C. Schlage Lock, Div. Ingersoll-Rand, Door Hardware Co.

2.2 ACCEPTABLE MANUFACTURERS

A. Hinges: Bommer Industries, Hager Hinge Co., Stanley and McKinney Products Co.

B. Latch Sets: Corbin, Yale, and Schlage.

C. Push/Pulls: Builder Brass Works Corp, H. B. Ives and Trimco.
Rockwood Manufacturing Co.

D. Cylinder Locks: Best Lock Corp, Corbin, and Yale.

E. Mortise Locks: Corbin, Yale, and Schlage, cast bronze.

F. Exit Devices: Corbin, Sargent, and Von Durpin

G. Closers: Dorma, LCN and Rixson, Corbin/Russwin.

H. Gasketing: Thresholds, National Guard Prod., Pemko, and Zero International

I. Protection Plates: Baldwin Hdw Corp., H.B. Ives, and Trimco.
Rockwood Manufacturing Co.

J. Keyless Entry: Locknetics.

2.3 KEYING

A. Door Locks: Keyed in like-groups. Master keyed. Grand master keyed. Include construction keying, control keying with removable core cylinders.

B. Supply keys in the following quantities:

1. 4 master keys.
2. 2 grand master keys.
3. 0 great grand master keys.
4. 2 construction keys.
5. 2 control keys and 2 extra cylinder cores.
6. 4 change keys for each lock bitting.
7. 250 touchentry key on key FOB.

2.4 KEY CABINET

A. Cabinet Construction: Sheet steel construction, piano hinged door with 6 pin tumbler type lock master keyed to building system.

B. Cabinet Size: Size for project keys plus 10 percent growth.

C. Horizontal metal strips for key hook labeling with clear plastic strip cover over labels.

D. Finish: Baked enamel, finish, color as selected.

2.5 FINISHES

A. Finishes: Identified in schedule at end of section.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions.

B. Use templates provided by hardware item manufacturer.

C. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
2. NWWDA Industry Standard I.S.1.7, "Hardware Location for Wood Flush Doors."

3.3 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

A. Adjust hardware for smooth operation.

3.5 PROTECTION OF FINISHED WORK

A. Do not permit adjacent work to damage hardware or finish.

3.6 SCHEDULES

SET 1
Single Door Non Rated
Office doors with key lockset, closer, BB butts
Each to have:
1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2267 NSR
1 Closer DC2200 - H.O.
1 Kick Plate
1 Mop Plate
1 Wallstop 409
3 Silencers 608

SET 2
Single Door Rated
Office Doors with key lockset, closer, BB butts
Each to have:
1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML 2267 NSR-C
1 Closer DC2200
1 Kick Plate
1 Mop Plate
1 Wallstop 409
3 Silencers 608

SET 3
NOT USED

SET 4
Single Door Non Rated
Closet door with lockset, BB hinges, inside knob/lever free
Each to have:
1-1/2 PR Butts BB1168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2200
1 Wallstop 409
3 Silencers 608
1 Mop Plate
1 Threshold

SET 5A
Single Door Non Rated
Door with classroom lockset, closer, lock or unlock by key, inside knob/free
Each to have:
1-1/2 PR Busst BB1168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2255NSR (LHRB) (Government Furnished Contractor Installed)
1 Closer DC2200
OR
1 Closer DC2200 PA (Parallel Arm) (PA)
1 Wallstop 409

3 Silencers 608
1 Kick Plate
1 Mop Plate

SET 5B
Single Door Non Rated
Door with classroom lockset, closer, lock or unlock by key, inside knob/free
Each to have:
1-1/2 PR Busst BB1168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2255NSR (RH) (Government Furnished Contractor Installed)
1 Closer DC2200
OR
1 Closer DC2200 PA (Parallel Arm) (PA)
1 Wallstop 409
3 Silencers 608
1 Kick Plate
1 Mop Plate

SET 6A
Single door Rated
Door with classroom lockset, closer, lock or unlock by key, inside knob/free.
Each to have:
1-1/2 PR Butts BB1168 Sec Stud 4-1/2 x 4-1/2
1 Lockset ML2255NSR (LH) (Government Furnished Contractor Installed)
1 Closer DC2200
OR
1 Closer DC2200 PA SNB
1 Wallstop 409
3 Silencers 608
1 Kick Plate
1 Mop Plate

SET 6B
Single door Rated
Door with classroom lockset, closer, lock or unlock by key, inside knob/free.
Each to have:
1-1/2 PR Butts BB1168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2255NSR (RH) (Government Furnished - Contractor Installed)
1 Closer DC2200
OR
1 Closer DC2200 PA SNB
1 Wallstop 409
3 Silencers 608
1 Kick Plate
1 Mop Plate

SET 7
Single Door Non Rated
Doors with lockset, BB hinges, closer, open with key only, inside knob/lever free.
Each to have:
1-1/2 PR BB Butts 1168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2257NSR
1 Wallstop 409
3 Silencers 608
1 Closer DC2200
1 Mop Plate

SET 8A
Single Door Rated
Doors with lockset, BB hinges, closer, open with key only, inside knob/lever free.
Each to have:
½ PR BB Butts BB1168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2257NSR
1 Wallstop 409
3 Silencers 608
1 Closer DC2200 SNB
1 Mop Plate

SET 8B
Single Door Rated
Doors with lockset, BB hinges, closer, open with key only, inside knob/lever free.
Each to have:
½ PR BB Butts 168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2257NSR (RH) (Government Furnished - Contractor Installed)
1 Wallstop 409
3 Silencers 608
1 Closer DC2200 SNB
1 Mop Plate

SET 8C
Single Door Rated
Doors with lockset, BB hinges, closer, open with key only, inside knob/lever free.
Each to have:
½ PR BB Butts 168 Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2257NSR (LH) (Government Furnished - Contractor Installed)
1 Wallstop 409
3 Silencers 608
1 Closer DC2200 SNB
1 Mop Plate

SET 9
Single Door Non Rated
Doors with push plate, pull plate, BB butts, closer, deadlock
Each to have:
1-1/2 PR Butts BB1168 4-1/2 x 4-1/2
1 Push Plate 6" x 18"
1 Pull Plate 4" x 16"
1 Closer DC2200
1 Wallstop 409
3 Silencers 608
1 Deadlock DL4017 Center Cyl 60" above bottom of frame
1 Kick Plate
1 Mop Plate

SET 10
Single Exterior Non Rated
Single exterior doors with exit device, closer, weatherstrip - threshold
Each to have:
1 Exit Device ED5200 Non Rated Door
  N7 Newport x Hi Security Cylinder
1 Closer P-DC2200 A5 (PA) (Parallel Arm)
  Extra heavy closer with back stop arm (add each for hold open)
1 Threshold (Handicap) Type 896X NGP Alum.
1/4" high - XMSLA
1 Set Weatherstrip Type PF182 NGP Char.

SET 11
Single Exterior Non Rated
Single exterior doors with exit device, closer, weatherstrip - threshold
Each to have:
1-1/2 PR Butts BB1199 4-1/2 x 4-1/2 Sec. Stud
1 Exit Device ED5200 Non Rated Door
  N7 Newport x Hi Security Cylinder
1 Closer P-DC2200 A5 (PA) (Parallel Arm)
  Extra heavy closer with back stop arm (add each for hold open)
1 Threshold (Handicap) Type 896X NGP Alum.
1/4" high - XMSLA
1 Set Weatherstrip Type PF182 NGP Char.

SET 12
Single Interior Rated
Single interior door to stairs
Each to have:
1-1/2 Pr Butts BB1199 4-1/2 x 4-1/2 - Sec. Stud
1 Exit Device, ED5200A - SNB
  N455 - Newport x Hi Security Cylinder
1 Closer P-DC2200-A5 (PA) (Parallel Arm)
1 Wallstop 409
3 Silencers 608
1 Kick Plate

1 Mop Plate

SET 13
Double Exterior Non Rated
Double exterior doors with exit device, closer, weatherstrip - threshold
Each to have:
3 PR Butts BB1199 4-1/2 x 4-1/2 Sec Stud
1 Exit Device ED5200
  N7 - Newport x Hi Security Cylinder (ACTIVE DOOR ONLY)
1 Closer P-DC2200 - A5 (PA) (Parallel Arm) (Active Door Only)
2 Flush Bolts 555
1 Threshold (Handicap) Type 896X NGP Alum.
1/4" high - XMSLA
1 Set Weatherstrip Type PF182 NGP Char.
507 Removable Mullion

SET 14
Interior Double Door Non Rated
Pair of doors with lock, flush bolts, act. door only.
Each to have:
3 PR Butts BB1168 4-1/2 x 4-1/2
1 Lockset ML2257NSR
2 Flush Bolts 555
1 Stop 409
2 Silencers 608
2 Kick Plates
2 Mop Plates

SET 15
Interior Double Door Rated
Pair of doors with lock, flush bolts, closer, Act. door only.
Each to have:
3 PR Butts BB1168 4-1/2 x 4-1/2
1 Lockset ML2257NSR
2 Flush Bolts 555 Automatic
2 Closers DC2200
1 Stop 409
2 Silencers 608
2 Kick Plates
2 Mop Plates

SET 16
Corridor Double Doors Non Rated
Pair corridor doors, interior, locked with exit devices.
Each to have:
3 PR Butts BB1168 4-1/2 x 4-1/2
1 Exit Device (RHR Active Door) ED 5400 x Newport N7 Trim
1 Exit Device (LHR Inactive Door) ED5400
2 Door Closers DC2200
2 Silencers 608

SET 17
Corridor Double Door Rated
Pair-Label corridor doors, interior, locked with exit devices.
Doors must fit within 3/8" of finish floor.
Each to have:
3 PR Butts BB1168 4-1/2 x 4-1/2
1 Exit Device (RHR-Active Door) - ED5400A x Newport N7 Trim
1 Exit Device (LHR Inactive Door) ED5400A
2 Door Closers DC2200
2 Wallstops 409
2 Silencers 608
2 Kick Plates
2 Mop Plates

SET 18
Single Door Rated
Breakroom door with push plate, pull plate, BB butts, closer, deadlock.
Each to have:
1-1/2 PR Butts BB1168 4-1/2 x 4-1/2
1 Push Plate 6" x 18"
1 Pull Plate 4" x 16"
1 Closer DC2200
1 Wallstop 409
2 Silencers 608
1 Deadlock DL4017 center cyl 60" above bottom of frame.
1 Kick Plate
1 Mop Plate

SET 19
Corridor Double Doors - Double Egress Non Rated
Double Egress Doors
Each to have:
3 PR Butts BB1168 4-1/2 x 4-1/2
2 Exit Devices ED5400 LHR
2 Door Closers Delayed Acting
2 Kick Plates
2 Silencers

SET 20
Single Door Non Rated
Dutch Door
Each to have:
2 PR Butts 1279 Sec. Stud 4-1/2 x 4-1/2
1 Lockset CL3251-IC-NSD (Lower leaf)
1 Deadlock DL 4017-HS (Upper leaf)
1 Flush Extension Bolt 555 - 6" Rod
1 Kick Plate
1 Mop Plate
1 Wallstop with hook
1 Wallstop
4 Silencers

SET 21
Hasp Lock
1 Padlock PD5000-IC-High Security

SET 22
Double Exterior Non Rated
Pair vestibule doors with exit device, closer, weatherstrip-threshold each to have:
3 PR Butts BB1199 4 ½ x 4 ½ Sec. Stud
2 Closers P-DC2200 - A5 (PA) (Parallel Arm)
1 Threshold (Handicap) Type 896 x NGP Alum 1/4" High - XMSLA
1 Set Weatherstrip Type PF182 NGP Char. 507 removable mullion
1 Exit Device - 6030 NF-EUB*TEL*ATR*MX500*628SF
1 Exit Device - 6030 NF*628SF

SET 23
Single Door Rated
Breakroom door with push plate, pull plate, BB butts, closer, deadlock.
Each to have:
1-1/2 PR Butts BB1168 4-1/2 x 4-1/2
1 Push Plate 6" x 18"
1 Pull Plate 4" x 16"
1 Closer DC2200
1 Wallstop 409
3 Silencers 608
1 Kick Plate
1 Mop Plate

SET 24
Single Door Non Rated
Office doors with key lockset, closer, BB butts
Each to have:
1-½ PR Butts BB1168 - Sec. Stud 4-½ x 4-½
1 Lockset ML2267 NSR (LH) (Government Furnished - Contractor Installed)
1 Closer DC2200 - H.O.
1 Kick Plate
1 Mop Plate
1 Wallstop 409
3 Silencers 608

SET 25
Single Door Non Rated
Office doors with key lockset, closer, BB butts
Each to have:
1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2267 NSR (RH) (Government Furnished - Contractor Installed)
1 Closer DC2200 - H.O.
1 Kick Plate
1 Mop Plate

1 Wallstop 409
3 Silencers 608

SET 26
Single Door Non Rated
Office doors with key lockset, closer, BB butts
Each to have:
1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
1 Lockset ML2267 NSR (RHR) (Government Furnished - Contractor Installed)
1 Closer DC2200 - H.O.
1 Kick Plate
1 Mop Plate
1 Wallstop 409
3 Silencers 608

SET 27
Single Door Non Rated
Office doors with key lockset, closer, BB butts
Each to have:
1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
1 Lockset - Keyless Entry
1 Closer DC2200 - H.O.
1 Kick Plate
1 Mop Plate
1 Wallstop 409
3 Silencers 608

Set 28C
Single Door Rated
Office Doors with key lockset, closer, BB butts
Each to have:
1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
1 Lockset - Keyless Entry
1 Closer DC2200
1 Kick Plate
1 Mop Plate
1 Wallstop 409
3 Silencers 608

SET 29
Single Door Non-Rated
Breakroom door with push plate, pull plate, BB butts, closer.
Each to have:
1-1/2 PR Butts BB1168 4-1/2 x 4-1/2
1 Push Plate 6" x 18"
1 Pull Plate 4" x 16"
1 Closer DC2200
1 Wallstop 409
3 Silencers 608
1 Kick Plate
1 Mop Plate

SET 30
Corridor Door Rated
Label corridor door, interior, locked with exit device.
Door must fit within 3/8" of finish floor.
Each to have:
1-1/2 PR Butts BB1168 4-1/2 x 4-1/2
1 Exit Device - ED5400A x Newport N7 Trim
Door Closer DC2200
1 Wallstop 409
1 Silencer 608
1 Kick Plate
1 Mop Plate

SET 31
Single Exterior Non Rated
Single exterior doors with exit device, closer, weatherstrip - threshold
Each to have:
1-1/2 PR Butts BB1199 4-1/2 x 4-1/2 Sec. Stud
1 Exit Device 6010 NF-EUB*TEL*ATR*MX54*48*628SF
1 Closer P-DC2200 A5 (PA) (Parallel Arm)
  Extra heavy closer with back stop arm (add each for hold open)
1 Threshold (Handicap) Type 896X NGP Alum.
1/4" high - XMSLA
1 Set Weatherstrip Type PF182 NGP Char.

SET 32
Single Vestibule Non Rated
Vestibule door with exit device, closer, weatherstrip-threshold
each to have:
1 1/2 PR Butts BB1199 4 ½ x 4 ½ Sec. Stud
1 Exit Device ED 5200X Newport N7 Trim
1 Closer P-DC2200 - A5 (PA) (Parallel Arm)
1 Threshold (Handicap) Type 896 x NGP Alum 1/4" High - XMSLA
1 Set Weatherstrip Type PF182 NGP Char. 507 removable mullion

SET 33
Single Vestibule Door with Exit Device.
1 Exit Device ED 5200X Newport N7 Trim.

3.7 DESCRIPTION

KICK PLATES - 8" HIGH DOOR WIDTH MINUS 2"
MOP PLATES - 4" HIGH DOOR WIDTH MINUS 1"
ALL .050 GA

FINISH

626 SATIN CHROME PLATED BRASS OR BRONZE METAL.
613 DARK OXIDIZED BRONZE

END OF SECTION

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass and glazing for hollow metal work, windows, glazed walls, doors.

1.2 RELATED SECTIONS

A. Section 08111 - Standard Steel Doors: Glazed doors.

B. Section 08211 - Flush Wood Doors: Glazed doors.

C. Section 08410 - Aluminum Entrances and Storefronts.

D. Section 08520 - Aluminum Windows: Glazed windows.

E. Section 10800 - Toilet and Bath Accessories: Mirrors.

1.3 REFERENCES

A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.

B. ASTM C804 - Use of Solvent-Release Type Sealants.

C. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D. ASTM C920 - Elastomeric Joint Sealants.

E. ASTM C1036 - Flat Glass.

F. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

G. ASTM E84 - Surface Burning Characteristics of Building Materials.

H. ASTM E283 - Test Method For Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.

I. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

J. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.

K. ASTM E576 - Test Method For Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.

L. ASTM E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.

M. ASTM E774 - Sealed Insulating Glass Units.

N. FGMA - Glazing Manual.

O. FGMA - Sealant Manual.

P. Laminators Safety Glass Association - Standards Manual.

Q. SIGMA - Sealed Insulated Glass Manufacturers Association.

1.4 PERFORMANCE REQUIREMENTS

A. Size glass to withstand positive and negative live loads acting normal to plane of glass to design pressures as indicated for the applications.

B. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

1.5 SUBMITTALS: Section 01300 - Submittals: Procedures for submittals.

A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Samples: Submit two samples 12 x 12 inch in size, exampling glass units, coloration.

1.6 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Procedures for submittals.

B. Certificates: Certify that Products meet or exceed specified requirements.

C. Manufacturer's Certificate: Certify that sealed insulated environmental glass, meets or exceeds specified requirements.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual, SIGMA and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience approved by manufacturer.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Conditions affecting products on site.

B. Do not install glazing when ambient temperature is less than 50 degrees F.

C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 WARRANTY

A. Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

B. Provide a five (5) year warranty to include coverage for delamination of laminated glass and replacement of same.

PART 2 PRODUCTS

2.1 FLAT GLASS MATERIALS

A. Manufacturers:

1. Libbey Owens Ford Designation LOF
2. PPG Industries, Inc. Designation PPG
3. Spectrum Glass Products

B. Float Glass (Type FG-A): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; 1/4 inch minimum thick.

C. Safety Glass (Type FG-B): Clear fully tempered with horizontal tempering laminated with plastic interlayer to ASTM C1172, Kind Clear 0.060 inch thick vinyl inter-layer; conforming to ANSI Z97.1; 7 mm minimum thick.

D. Tinted Glass (Type FG-C): Float type, heat strengthened light reducing in grey color; light transmittance of 42 percent, shading coefficient of 0.66, 1/4" minimum thick.

2.2 SEALED INSULATING GLASS MATERIALS

A. Manufacturers:

1. Libbey Owen Ford Designation LOF
2. PPG Designation PPG
3. Spectrum Glass Products, Inc. Designation

B. Insulated Glass Units (Type SG-A): ASTM E774 and E773; double pane with silicone sealant edge seal; outer pane of grey tinted glass, inner pane of clear glass, purge interpane space with dry hermetic air; total unit thickness of 1 inch.

C. Edge Seal Construction: Stainless steel, bent and soldered mitered and spigoted corners.

2.3 GLAZING ACCESSORIES

A. Setting Blocks: ASTM C864 Option I Neoprene, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: ASTM C864 Option I, Neoprene, 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.

B. Verify that openings for glazing are correctly sized and within tolerance.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Perform installation in accordance with ASTM C804 for solvent release sealants.

3.3 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.4 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.5 FIELD QUALITY CONTROL

A. Section 01440 - Quality Control: Field inspection.

B. Inspection will monitor quality of glazing.

3.6 MANUFACTURER'S FIELD SERVICES

A. Glass and glazing product manufacturers to provide field surveillance of the installation of their Products.

B. Monitor and report installation procedures and unacceptable conditions.

3.7 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.8 PROTECTION OF FINISHED WORK

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

3.9 SCHEDULE

A. Exterior Windows: Types FG-C, exterior wet/dry method with Type GC-F compound.

B. Exterior Entrances: Types FG-C gray tint 3/8 inch thick, exterior wet/dry method with Type GC-E compound.

C. Interior Metal Doors: Type FG-A clear float 1/4" thick, interior wet method with Type GC-A compound.

D. Interior Windows: Type FG-B clear acrylic, interior dry method.

END OF SECTION

SECTION 09111

METAL STUD FRAMING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed metal stud framing at interior locations.

B. Framing accessories.

1.2 RELATED SECTIONS

A. Section 04320 - Veneer Masonry System: Veneer masonry supported by stud wall metal framing.

B. Section 05400 - Cold-Formed Metal Framing: Structural load bearing metal stud framing.

C. Section 06114 - Wood Blocking and Curbing: Rough wood blocking within stud framing.

D. Section 09260 - Gypsum Board System: Wall sheathing.

E. Section 07213 - Batt and Blanket Insulation: Insulation within framing members.

F. Section 07900 - Joint Sealers.

G. Section 09260 - Gypsum Board Systems: Metal studs for partitioning.

1.3 REFERENCES

A. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

C. ASTM A591 - Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated.

D. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.

E. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.

F. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.

G. Metal Framing Manufacturers Association (MFMA) - Guidelines for the Use of Metal Framing.

H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 SYSTEM DESCRIPTION

A. Metal stud framing system for exterior wall metal fascia, with exterior sheathing specified in Section 09260, batt insulation specified in Section 07213, interior gypsum board specified in Section 09260.

B. Metal stud framing system for interior walls, with batt type acoustical insulation specified in Section 09260 interior gypsum board specified in Section 09260.

C. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

D. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate component details, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.

B. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts, and limitations.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with GA 203, MFMA and ASTM C754.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing the work of

this section with minimum six years documented experience approved by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Dietrich Industries, Inc.

B. Gold Bond Building Products Division, National Gypsum Co.

C. Unimast Incorporated

2.2 STUD FRAMING MATERIALS

A. Studs: ASTM A525 and C645, non-load bearing rolled steel, channel shaped, punched for utility access, as indicated on the drawings.

1. Minimum Thickness: 18 gage.

B. Runners: Of same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

C. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.

D. Fasteners: GA 203. Self drilling, self tapping screws.

E. Sheet Metal Backing: 20 gage (0.9 mm thick) galvanized steel for reinforcement of corners.

F. Anchorage Devices: Power actuated.

G. Acoustic Sealant: As specified in Section 09260.

H. Touch-Up Primer for Galvanized Surfaces: SSPC - Paint 20 Type I Inorganic zinc rich.

2.3 FINISHES

A. Studs: Galvanize to G90 coating class.

B. Tracks and Headers: Galvanize to G90 coating class.

C. Accessories: Same finish as framing members. ASTM A123, hot dip galvanized to 1.25 oz/sq ft (380 gm/sq m).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are ready to receive work.

B. Verify that rough-in utilities are in proper location.

3.2 ERECTION

A. Align and secure top and bottom runners at 24 inches (600 mm) oc.

B. Place two beads of acoustical sealant between runners and substrate to achieve an acoustical seal.

C. Place two beads of acoustic sealant between studs and adjacent vertical surfaces to achieve an acoustical seal.

D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

E. Install studs vertically at 16 inches (400 mm) oc.

F. Align stud web openings horizontally.

G. Secure studs to tracks using crimping method. Do not weld.

H. Stud splicing not permissible.

I. Fabricate corners using a minimum of three studs.

J. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

K. Brace stud framing system rigid.

L. Coordinate erection of studs with requirements of door frames, window frames, and install supports and attachments.

M. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.

N. Blocking: Secure wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and any equipment anchored to wall.

O. Refer to Drawings for indication of partitions extend stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

P. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.

3.3 ERECTION TOLERANCES

A. Maximum Variation From True Position: 1/8 inch.

B. Maximum Variation of any Member from Plane: 1/8 inch.

C. Maximum Variation From Plumb: 1/8 inch.

END OF SECTION

SECTION 09260

GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal channel ceiling framing.

C. Acoustical insulation.

D. Gypsum board.

E. Gypsum sheathing.

F. Cementitious backer board.

G. Taped and sanded joint treatment.

1.2 RELATED SECTIONS

A. Section 06114 - Wood Blocking and Curbing: Wood blocking for support of Toilet and Bath Accessories.

B. Section 07213 - Batt Insulation: Thermal insulation.

C. Section 08112 - Standard Steel Frames.

D. Section 09111 - Metal Stud Framing System.

E. Section 09900 - Painting: Surface finish.

F. Section 09955 - Vinyl Coated Fabric Wall Covering: Surface finish.

1.3 REFERENCES

A. ASTM C36 - Gypsum Wallboard.

B. ASTM C79 - Gypsum Sheathing Board.

C. ASTM C442 - Gypsum Backing Board and Core Board.

D. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.

E. ASTM C514 - Nails for the Application of Gypsum Wallboard.

F. ASTM C557 - Adhesive for Fastening Gypsum Wallboard to Wood

Framing.

G. ASTM C630 - Water Resistant Gypsum Backing Board.

H. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

I. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

J. ASTM C754 - Installation of Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.

K. ASTM C840 - Application and Finishing of Gypsum Board.

L. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.

M. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

N. ASTM E119 - Fire Tests of Building Construction and Materials.

O. GA-201 - Gypsum Board for Walls and Ceilings.

P. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

Q. GA-600 - Fire Resistance Design Manual.

1.4 SYSTEM DESCRIPTION

A. Acoustical Attenuation for Identified Interior Partitions: Required STC in accordance with ASTM E90 are indicated on the Drawings.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate special details associated with fireproofing and acoustical seals.

B. Product Data: Provide data on metal framing, gypsum board, joint tape.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840, GA-201, GA-216 and GA-600. Refer to the installation guide of one of the listed manufacturers hereinafter for installation of gypsum

sheathing.

1.7 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum five years documented experience approved by manufacturer.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies in conjunction with Section 05400 and 09111 as follows:
1. Fire Rated Partitions: Listed assembly by UL

PART 2 PRODUCTS

2.1 MANUFACTURERS - GYPSUM BOARD SYSTEM

A. Acceptable manufacturers offering equivalent products.
1. Georgia Pacific Corp.
2. Gold Bond Building Products Div., National Gypsum Co.
3. United States Gypsum Company

2.2 FRAMING MATERIALS

A. Studs and Tracks: ASTM C645; GA-216 and GA-600; galvanized sheet steel, 20 gage 0.55 mm) thick, C shape.

B. Furring, Framing and Accessories: ASTM C645. GA-216 and GA-600.

C. Fasteners: ASTM C1002.

D. Anchorage to Substrate: Tie wire, nails, screws and other metal supports, of type and size to suit application; to rigidly secure materials in place.

2.3 GYPSUM BOARD MATERIALS

A. Standard Gypsum Board: ASTM C36; 5/8 inch (16 mm) thick, maximum permissible length; ends square cut, tapered edges.

B. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 5/8 inch (16 mm) thick, maximum permissible length; ends square cut, tapered edges.

C. Moisture Resistant Gypsum Board: ASTM C630; 5/8 inch (16 mm) thick, maximum permissible length; ends square cut, tapered and beveled edges.

D. Gypsum Sheathing Core Board (faced both sides with

fiberglass mat): Conform to ASTM C79 and in accordance with ASTM C1177 with glass mats both sides and long edges. Size: 1/2" (13mm) thick by 4' by 8', 9' or 10'. Flame spread O, smoke developed O, when tested in accordance with ASTM E 84.

E. Gypsum Core Board: ASTM C442, 1 inch (25 mm) thick, maximum permissible length; square edges, ends square cut.

F. Cementitious Backing Board: High density, glass fiber reinforced, 1/2 inch (13 mm) thick; 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.

2.4 ACCESSORIES

A. Acoustical Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, thickness as required to fill the cavity of the partition where indicated.

B. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

C. Corner Beads: Metal.

D. Edge Trim: See drawing for type required.

E. Joint Materials: ASTM C475; GA 201 and GA 216; reinforcing tape, joint compound, adhesive, and water.

F. Fasteners: ASTM C1002, Type S12.

G. Building paper: No. 15, non perforated, asphalt saturated felt complying with ASTM D226, Type 1 or equivalent.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 METAL STUD INSTALLATION

A. Install studs in accordance with ASTM C754 or manufacturer's instructions also, see Section 09111 - Metal Stud Framing System.

B. Metal Stud Maximum Spacing: 16 inches (400 mm) on center.

C. Refer to Drawings for indication of partitions extend stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg

ceiling runners.

D. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.

E. Blocking: Nail wood blocking to studs. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, and toilet accessories.

3.3 WALL FURRING INSTALLATION

A. Erect wall furring for direct attachment to concrete block walls.

B. Install thermal insulation in conjunction with Section 07213 vertically and hold in place with Z-furring channels spaced maximum 24 inches (600 mm) on center, not more than 3 inches (75 mm) from external corners and 12 inches (300 mm) at internal corners. Secure Z-furring channels maximum 24 inches (600 mm) on center.

3.4 FURRING FOR FIRE RATINGS

A. Install furring as required for fire resistance ratings indicated [and to GA-600 requirements].

3.5 CEILING FRAMING INSTALLATION

A. Install in accordance with ASTM C754 and with manufacturer's instructions.

B. Coordinate location of hangers with other work.

C. Install ceiling framing independent of walls, columns, and above ceiling work.

D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each end of openings.

E. Laterally brace entire suspension system.

3.6 ACOUSTICAL ACCESSORIES INSTALLATION

A. Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.

B. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical

and mechanical items within or behind partitions, and tight to items passing through partitions.

C. Install acoustical sealant within partitions in accordance with manufacturer's instructions.

3.7 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with manufacturer's instructions.

B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Erect single layer fire rated gypsum board with edges and ends occurring over firm bearing.

D. Erect exterior gypsum sheathing horizontally, with edges butted tight and ends occurring over firm bearing.

E. Use screws when fastening gypsum board to metal furring or framing.

F. Double Layer Applications: Secure second layer to first with fasteners.

G. Offset joints of second layer from joints of first layer.

H. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.

I. Treat cut edges and holes in moisture resistant gypsum board with sealant.

J. Place control joints consistent with lines of building spaces as directed.

K. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.

L. Install backing board over metal studs in accordance with manufacturer's instructions.

M. Apply gypsum board to curved walls in accordance with GA-216.

3.8 JOINT TREATMENT

A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch (0.8 mm).

C. Tape joints and corners of cementitious backing board.

3.9 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09306

FLOOR TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ceramic and Quarry tile floor and base finish using the thinset and mortar bed application method.

B. Threshold at door opening.

1.2 RELATED SECTIONS

A. Section 07900 - Joint Sealers: Mildew resistant sealant.

B. Section 09307 - Wall Tile.

C. Section 15430 - Plumbing Specialties: Floor drains.

D. Section 15440 - Plumbing Fixtures: Shower pan receptor.

1.3 REFERENCES

A. ANSI A108.1 - Installation of Ceramic Tile with Portland Cement Mortar.

B. ANSI A108.3 - Quarry Tile and Paver Tile Installed With Portland Cement Mortar.

C. ANSI A108.4 - Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.

D. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.

E. ANSI A108.10 - Installation of Grout in Tilework.

F. ANSI A118.1 - Dry-Set Portland Cement Mortar.

G. ANSI A118.4 - Latex-Portland Cement Mortar.

H. ANSI A118.6 - Ceramic Tile Grouts.

I. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.

J. ANSI A137.1 - Standard Specifications for Ceramic Tile.

K. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

B. Product Data: Provide instructions for using adhesives and grouts.

C. Samples: Manufacturer’s sample board showing full range of colors.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements. ANSI A137.1.

1.5 MAINTENANCE DATA

A. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A137.1.

B. Conform to TCA Handbook, ANSI A108.1, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.10.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum four years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives in an unventilated environment.

B. Maintain 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2 PRODUCTS

2.1 TILE MANUFACTURERS

A. American Olean Tile Co., Inc.

B. Dal-Tile Corp.

C. Monarch Tile Manufacturing, Inc.

2.2 CERAMIC TILE MATERIALS

A. Ceramic Mosaic Floor Tile: ANSI A137.1, conforming to the following:

1.	Moisture Absorption	0 to 0.5 percent
2.	Size	2" x 2" x 1/4 inch 1" x 1" x 1/4 inch
3.	Shape	square
4.	Edge	cushioned
5.	Surface Finish	unglazed slip resistant
6.	Color	as selected on finish Schedule

2.3 QUARRY MATERIALS

A. Quarry Tile: ANSI A137.1, conforming to the following:

1.	Moisture Absorption	0 to 0.5 percent
2.	Size	6 x 6 x 1/2 inch
3.	Shape	square
4.	Edge	square
5.	Surface Finish	unglazed non-slip
6.	Color	as selected on Finish Schedule

2.4 BASE MATERIALS

A. Base: Match floor tile for moisture absorption, surface finish, and color:

1.	Length	6
2.	Height	5 inch (102 mm)
3.	Thickness	1/2"

4. Top Edge — bull nosed

5. External Corner — bullnosed

2.5 MORTAR MATERIALS

A. Manufacturers:

1. Bostik Construction Products, Div., Product: Hydroment
2. Laticrete International, Inc.
3. Mapei Corporation

B. Mortar Materials: ANSI A118.1 Dry Set, Portland cement, sand, latex additive, and water.

2.6 GROUT MATERIALS

A. Manufacturers:

1. Bostik Construction Products, Div., Product: Hydroment
2. Laticrete International, Inc.
3. Mapei Corporation

B. Grout: ANSI A118.3,100% solids chemical resistant grout.

2.7 ACCESSORIES

A. Thresholds: Protective edge trim that provides a sloped transition from a higher tiled covering to an adjoining lower surface.

2.8 MORTAR MIX AND GROUT MIX

A. Mix and proportion cementitious materials for site made slurry coat, mortar bed and bond coat.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

3.2 PREPARATION

A. Protect surrounding work from damage or disfiguration.

B. Vacuum clean surfaces.

C. Seal substrate surface cracks with filler.

D. Apply conditioner to substrate surfaces in accordance with

adhesive manufacturer's instructions.

3.3 INSTALLATION - THINSET METHOD

(See wall tile note detail)

A. Install adhesive tile, thresholds, and grout in accordance with manufacturer's instructions.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Place thresholds edge strips at exposed tile edges, locations indicated.

D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base joints.

E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

F. Sound tile after setting. Replace hollow sounding units.

G. Keep control joints free of adhesive or grout. Apply sealant to joints.

H. Allow tile to set for a minimum of 48 hours prior to grouting.

I. Grout tile joints.

J. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.3 CLEANING

A. Clean tile and grout surfaces.

3.4 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09307

WALL TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ceramic tile wall finish using the thinset application method.

B. Cementitious backing board.

1.2 RELATED SECTIONS

A. Section 04311 - Concrete Masonry Units: Wall substrate surface.

B. Section 09220 - Portland Cement Plaster: Base coat for tile finish.

C. Section 07900 - Joint Sealers: Mildew resistant sealant.

D. Section 09306 - Floor Tile.

E. Section 15440 - Plumbing Fixtures: Shower pan receptor.

1.3 REFERENCES

A. ANSI A108.1 - Installation of Ceramic Tile with Portland Cement Mortar.

B. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.

C. ANSI A108.10 - Installation of Grout in Tilework.

D. ANSI A118.1 - Dry-Set Portland Cement Mortar.

E. ANSI A118.4 - Latex-Portland Cement Mortar.

F. ANSI A118.6 - Ceramic Tile Grouts.

G. ANSI A137.1 - Standard Specifications for Ceramic Tile.

H. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate tile layout, color arrangement, perimeter conditions, junctions with dissimilar materials,

control and expansion joints, thresholds, and setting details.

B. Product Data: Provide instructions for using adhesives and grouts.

C. Submit manufacturers sample board that shows samples: Mount tile and apply grout on two plywood panels, 12 x 12 inch in size illustrating pattern, color variations, and grout joint size variations. Full range on color.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements. ANSI A137.1.

1.5 MAINTENANCE DATA

A. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A137.1.

B. Conform to TCA Handbook, ANSI A108.1, ANSI A108.4, ANSI A108.5, ANSI A108.10.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum four years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather and stored under cover.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives in an unventilated environment.

B. Maintain 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.1 TILE MANUFACTURERS

A. American Olean Tile Co., Inc.

B. Dal-Tile Corp.

C. Monarch Tile Manufacturing, Inc.

2.2 CERAMIC TILE MATERIALS

A. Glazed Wall Tile: ANSI A137.1, conforming to the following:

1.	Moisture Absorption	0 to 0.5 percent
2.	Size	4-1/4 x 4-1/4 x 5/16 inch
3.	Shape	square
4.	Edge	cushioned
5.	Surface Finish	glazed
6.	Color	as selected on Finish Schedule

2.3 MORTAR MATERIALS

A. Manufacturers:

1. Bostik Construction Products, Div. Product: Hydroment
2. Laticrete International, Inc.
3. Mapei Corporation

B. Mortar Materials: ANSI A118.4 Latex Modified, Portland cement, sand, latex additive, and water for installation of ceramic tile on C.M.U.

2.4 GROUT MATERIALS

A. Manufacturers:

1. Bostik Construction Products, Div. Product: Hydroment
2. Laticrete International, Inc.
3. Mapei Corporation

B. Grout: ANSI A118.6, tile grout, color as selected. Wall grout to be dry polymer-modified, high density, mildew resistant formula.

2.5 ACCESSORIES

A. Membrane: No. 15 (6.9 kg) asphalt saturated felt.

B. Backing Board: High density, cementitious, glass fiber reinforced, ½ inch thick; 2 inch (50 mm) wide coated glass fiber tape for joints and corners; Dens-Shield manufactured by Georgia Pacific Corporation.

2.6 MORTAR MIX AND GROUT MIX

A. Mix and proportion cementitious materials for site made slurry coat, mortar bed and bond coat.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

3.2 PREPARATION

A. Protect surrounding work from damage or disfiguration.

B. Vacuum clean surfaces.

C. Seal substrate surface cracks with filler.

3.3 INSTALLATION - THINSET METHOD

In wet areas were glazed 4 1/4" x 4 1/4" wall tile is specified, use installation method W244-99 from TCA Handbook.

A. Install adhesive tile and grout in accordance with manufacturer's instructions.

B. Install backing board over metal studs in accordance with board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

C. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base and wall joints.

E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

F. Form internal angles coved and external angles bullnosed.

G. Install ceramic accessories rigidly in prepared openings.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control joints free of adhesive or grout. Apply sealant to joints.

J. Allow tile to set for a minimum of 48 hours prior to grouting.

K. Grout tile joints.

L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.3 CLEANING

A. Clean work under provisions.

B. Clean tile and grout surfaces.

C. Provide Owner with manufacturer recommendation on care and maintenance.

END OF SECTION

SECTION 09511

SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system and perimeter trim.

B. Acoustical panels.

C. Non-fire rated assembly.

1.2 RELATED SECTIONS

A. Section 07213 - Batt and Blanket Insulation.

B. Section 08305 - Access Doors: Access panels.

C. Section 10651 - Operable Panel Partitions: Acoustical partition system.

D. Section 15375 - Sprinkler Systems: Sprinkler heads in ceiling system.

E. Section 15936 - Air Outlets and Inlets: Air diffusion devices in ceiling system.

F. Section 16510 - Interior Luminaires: Light fixtures in ceiling system.

G. Section 16721 - Fire Alarm and Smoke Detection Systems: Fire alarm components in ceiling system.

H. Section 16770 - Public Address and System.

1.3 REFERENCES

A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

C. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

D. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

E. ASTM E1264 - Classification of Acoustical Ceiling Products.

F. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.

G. UL - Fire Resistance Directory and Building Material Directory.

1.4 SYSTEM DESCRIPTION

A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to acoustical system.

B. Product Data: Provide data on metal grid system components and acoustical units.

C. Samples:

1. Submit two samples, 12" X 12", illustrating material and finish of acoustical units.
2. Submit two samples each, 12 inches long, of suspension system main runner, cross runner, edge trim, and suspension wires.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.6 QUALIFICATIONS

A. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

B. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.8 SEQUENCING

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

PART 2 PRODUCTS

2.1 MANUFACTURERS - SUSPENSION SYSTEM

A. Armstrong World Industries, Inc.

B. Chicago Metallic Corporation

C. USG Interiors, Inc.

2.2 SUSPENSION SYSTEM MATERIALS

A. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T components die cut and interlocking.

B. Grid Materials: Commercial quality cold rolled steel with galvanized coating. Cold rolled aluminum.

C. Exposed Grid Surface Width: 15/16 inch.

D. Grid Finish: White color as selected.

E. Accessories: Stabilizer bars, clips, splices, edge moldings required for suspended grid system.

F. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

2.3 MANUFACTURERS - ACOUSTICAL UNITS

A. Armstrong World Industries, Inc.

B. Celotex: The Celotex Corporation.

C. USG Interiors, Inc.

2.4 ACOUSTICAL UNIT MATERIALS

A. Type I Acoustical Panels: ASTM E1264
   1. Size: 24 x 24 inches
   2. Thickness: 3/4 inches
   3. Composition: Wet formed mineral fiber

4. Density: 20 lbs/cu ft
5. Light Reflectance: 75 percent
6. NRC Range: .60 to .70
7. Fire Hazard Classification: 25
8. Joint: Revealed
9. Edge: Beveled tegular
10. Surface Color: White
11. Surface Finish: Factory applied vinyl latex paint; non-directional.

B. Type II Acoustical Panels: ASTM E1264, conforming to the following:

1. Size: 24 x 24 inches.
2. Thickness: 5/8 inches.
3. Composition: Woven glass fiber with vinyl-faced
4. Density: 4.8 lb/cu ft
5. Light Reflectance: 75 percent.
6. NRC Range: .60 to .70.
7. Fire Hazard Classification: flame spread of 25
8. Edge: Square.
9. Surface Color: White.
10. Surface Finish: Washable vinyl film facing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636 and as supplemented in this section.

B. Install system in accordance with ASTM E580.

C. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

E. Locate system on room axis according to reflected plan.

F. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

G. Supply hangers or inserts for installation to Section 09511 with instructions for their correct placement.

H. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

I. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

J. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

K. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

L. Do not eccentrically load system, or produce rotation of runners.

M. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

N. Seismic bracing for mechanical, electrical, and acoustical ceiling systems shall be in conformance with requirements for Seismic Zone 2A.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Install units after above ceiling work is complete.

D. Install acoustical units level, in uniform plane, and free from twist, warp and dents.

E. Cut panels to fit irregular grid and perimeter edge trim. Panel edge. Double cut and field paint exposed edges of tegular units.

F. Where round obstructions occur, provide preformed closers to match edge molding.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.

1.2 RELATED SECTIONS

A. Section 04311 - Concrete Masonry Units.

B. Section 09260 - Gypsum Board System.

1.3 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.

B. ASTM F1066 - Vinyl Composition Floor Tile.

C. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate borders, patterns, and direction of the grain.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples:

1. Submit two samples, 12 x 12 inch in size illustrating color and pattern for each floor material for each color specified.
2. Submit two inch long samples of base material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in original unopened packages, bundles or containers and with all labels intact. Resilient flooring shall be stored in

fully covered, well ventilated areas and protected from extreme changes in temperature and humidity. Temperature and humidity in the storage area shall closely approximate the temperature and humidity of the rooms in which the flooring is to be installed.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.7 MAINTENANCE DATA

A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

PART 2 PRODUCTS

2.1 MATERIALS - TILE FLOORING

A. Vinyl Composition Tile: ASTM F1066:

1. Size: 12 x 12 inch.
2. Thickness: 1/8 inch.
3. Design: marbleized.
4. Manufacturers:

a) Armstrong World Industries, Inc.
b) Azrock Industries, Inc.
c) Tarkett

B. Static Dissipative Solid Vinyl Tile

1. Size: 12 x 12 inch.
2. Thickness: 1/8 inch.
3. Design: marbleized.
4. Manufacturers:

a) Flexco Company
b) American Biltrite
c) Armstrong World Industries, Inc.

2.2 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by

adhesive material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Edge Strips: Flooring material; manufactured by Johnsonite.

D. Cant Strip: Metal.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.

B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION - TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

F. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

G. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. Install flooring in pan type floor access covers. Maintain floor pattern.

J. At movable partitions install flooring under partitions without interrupting floor pattern.

3.4 INSTALLATION - BASE

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tight to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

A. Remove access adhesive from floor, base, and wall surfaces without damage.

B. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

3.6 PROTECTION OF FINISHED WORK

A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION

SECTION 09651

RUBBER TILE FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rubber tile flooring.

B. Rubber base.

1.2 RELATED SECTIONS

A. Section 04311 - Concrete Masonry Units.

B. Section 09260 - Gypsum Board System.

1.3 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.

B. ASTM F1344, 1991, Class I.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate borders, patterns, and direction of the grain.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples:

1. Submit two samples, 12 x 12 inch in size illustrating color and pattern for each floor material for each color specified.
2. Submit two inch long samples of base material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in original unopened packages, bundles or containers and with all labels intact. Resilient flooring shall be stored in fully covered, well ventilated areas and protected from

extreme changes in temperature and humidity. Temperature and humidity in the storage area shall closely approximate the temperature and humidity of the rooms in which the flooring is to be installed.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.7 MAINTENANCE DATA

A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

PART 2 PRODUCTS

2.1 MATERIALS - TILE FLOORING

A. Rubber Landing Tile Flooring: ASTM F1344, 1991, Class I-A.

1. Size: 12 x 12 inches.
2. Thickness: .125 inch.
3. Design: Diamond.
4. Manufacturers:

    a) Burke Flooring Products Division of Burke Industries
    b) Marathon
    c) Johnsonite, Div. of Duramax, Inc.

2.2 MATERIALS - BASE

A. Base: FS SS-W-40, Type I rubber; Rubber; top set coved; premolded external corners:

1. Height: 4 inch
2. Thickness: 1/8 inch thick
3. Length: Roll.
4. Manufacturers:

    a) Burke Flooring Products Division of Burke Industries
    b) Roppe Corporation
    c) Johnsonite, Div of Duramax, Inc.

B. Base Accessories: Premolded end stops, internal and external corners, of same material, size, and color as base.

2.3 MATERIALS - RUBBER TREADS AND RISERS

A. Rubber Treads:

1. Size: 4' x 13 1/4".
2. Thickness: .125".
3. Design: Heavy-Duty Diamond.
4. Manufacturers:

a) Johnsonite, Div. of Duramax, Inc.
b) Roppe Corporation
c) Burke Flooring Products Division of Burke Industries

2.4 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Edge Strips: Flooring material; manufactured by Johnsonite.

D. Cant Strip: Metal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.

B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION - TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

F. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

G. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. Install flooring in pan type floor access covers. Maintain floor pattern.

3.4 INSTALLATION - BASE

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tight to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

A. Remove access adhesive from floor, base, and wall surfaces without damage.

B. Clean and buff floor and base surfaces in accordance with manufacturer's instructions.

3.6 PROTECTION OF FINISHED WORK

A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION

SECTION 09690

CARPET TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet tiles.

B. Matching roll carpet.

C. Accessories.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete: Floor substrate surface.

B. Section 09650 - Resilient Flooring: termination edging of adjacent floor finish.

C. Section 09260 - Gypsum Board System: Wall materials to receive application of base.

D. Section 09650 - Resilient Flooring: Base finish.

1.3 REFERENCES

A. ASTM D2859 - Test Method for Flammability of Finished Textile Floor Covering Materials.

B. ASTM E84 - Surface Burning Characteristics of Building Materials.

C. ASTM E648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

D. NFPA 253 - Test for Critical Radiant Flux of Floor Covering Systems.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate layout of joints, direction of carpet weave, and transitions to other materials.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and

pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the specified carpet in this Section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this Section with minimum six years documented experience. and approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Conform to NFPA 253 ASTM E648 Class II for flooring radiant panel test.

B. Conform to ASTM D2859 for surface flammability ignition test.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Store materials for 3 days prior to installation in area of installation, to achieve temperature stability.

B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature three days prior to, during and 24 hours after installation materials.

1.8 MAINTENANCE DATA

A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

PART 2 PRODUCTS

2.1 MANUFACTURERS - CARPET TILE

A. Collins & Aikman: Products - Plexus Accent, Modular Tile, Style #60019 Claret.

B. Interface: Products - Carribbean 3080 Antigua.

2.2 CARPET TILE

A. Carpet Tile: Fusion Bonded, Plexus Accent, Modular Tile, Style #60019 Claret, manufactured in one color dye lot, conforming to the following criteria:

Yarn System

Color System
Lifetime Antimicrobial
Soil/Stain Protection
Yarn Weight
Pile Thickness
Tuft Gauge
Tufts
Tuft Density
Pile Density
Weight Density

B. Carpet Tile: Fusion bonded, Caribbean Modular Tile, Style #3080 Antigua, manufactured in one color dye lot, conforming to the following criteria:

Yarn System

	67% Dupont Antron Lumena 33% Dupont Antron Legacy
Color System	49% Solution Dyed 51% Yarn Dyed
Lifetime Antimicrobial	Intersept
Soil/Stain Protection	Protect with Dupont Duratech
Yarn Weight	24 oz./sq. yd.
Pile Thickness	.138 in
Tuft Gauge	1/12
Tufts	9/IN
Tuft Density	108/sq. in.
Pile Density	6261
Weight Density	150,261

2.3 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Primers and Adhesives: Compatible with carpet material. Recommended by carpet manufacturer. Releasable type.

C. Edge Strips: Plastic type, black finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are smooth and flat with maximum variation of 1/4 inch in 10 ft (6 mm in 3 m), and are ready to receive work.

B. Verify concrete floors are dry to a maximum moisture content of 7 percent; and exhibit negative alkalinity, carbonization, or dusting.

3.2 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION

A. Install carpet tile accessories and adhesive in accordance with manufacturer's instructions.

B. Integrate and blend carpet from different cartons to ensure minimal variation in color match.

C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

D. Lay carpet tile to ashlar pattern, tile direction parallel to next unit, set parallel to building lines.

E. Locate change of color or pattern between rooms under door centerline.

F. Fully adhere carpet tile to substrate.

G. Bind cut edges where not concealed by edge strips.

3.4 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and field application of paints and coatings.

1.2 RELATED SECTIONS

A. Section 05500 - Metal Fabrication: Shop primed items.

B. Section 15190 - Mechanical Identification.

C. Section 16195 - Electrical Identification.

1.3 REFERENCES

A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D2016 - Test Method for Moisture Content of Wood.

C. AWWA (American Water Works Association) - C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.

D. AWWA (American Water Works Association) - D102 - Painting Steel Water Storage Tanks.

E. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.

F. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.

G. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.

H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Data: Provide data on all finishing products.

B. Samples: Submit two samples, 12 x 12 inch in size illustrating selected colors for each color selected.

C. Manufacturer's Instructions: Indicate special surface preparation procedures, substrate conditions requiring special attention.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum six years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
Product name or title of material.
Product description (generic classification or binder type).
Manufacturer's stock number and date of manufacture.
Contents by volume, for pigment and vehicle constituents.
Thinning instructions.
Application instructions.
Color name and number

B. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

C. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Paint

1. Devoe and Reynolds Co. (Devoe)
2. The Glidden Company (Glidden)
3. The Sherwin-Williams Company (S-W)

B. Manufacturers - Transparent Finishes

1. Devoe
2. Glidden
3. S-W

C. Manufacturers - Stain

1. Devoe
2. Glidden
3. S-W

D. Manufacturers - Primer Sealers

1. Devoe
2. Glidden
3. S-W

E. Manufacturers - Block Filler

1. Devoe
2. Glidden
3. S-W

2.2 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

2.3 FINISHES

A. Refer to schedule at end of section for surface finish and color schedule.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D2016.
5. Concrete Floors: 8 percent.

3.2 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing

surfaces or finishing.

B. Correct defects and clean surfaces which affect work of this section.

C. Seal with shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

H. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

J. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

K. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

L. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

M. Shop Primed Steel Surfaces: Sand and scrape to remove

loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

N. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

O. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied.

P. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand wood and metal lightly between coats to achieve required finish.

F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

G. Allow applied coat to dry before next coat is applied.

H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Section 15190 and Section 16195 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.

B. Paint shop primed equipment.

C. Remove unfinished louvers, grilles, covers, and access

panels on mechanical and electrical components and paint separately.

D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

E. Paint interior surfaces of air ducts, that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, to match face panels.

F. Paint exposed conduit and electrical equipment occurring in finished areas.

G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 CLEANING

A. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

A. Metal Fabrications (Section 05500): Exposed surfaces of lintels, elevator pit ladders.

B. Metal Stairs (Section 05510): Exposed surfaces of stringers, exposed vertical risers.

3.7 SCHEDULE - EXTERIOR SURFACES

A. Cement Plaster Soffits

1. One coat of primer sealer latex.
2. Two coats of Quick-drying semi-gloss, acrylic paint.

B. Steel - Galvanized:

1. One coat galvanize primer.
2. Two coats of alkyd enamel, semi-gloss.

3.8 SCHEDULE - INTERIOR SURFACES

A. Wood - Painted:

1. One coat of latex prime sealer.
2. Two coats of latex enamel, eggshell.

B. Concrete, Concrete Block, Cement Plaster:

1. One coat of primer sealer latex.
2. Two coats of latex semi-gloss.

G. Steel - Unprimed:

1. One coat of alkyd primer.
2. Two coats of alkyd enamel, semi-gloss.

H. Steel - Primed:

1. Touch-up with alkyd primer.
2. Two coats of alkyd enamel, semi-gloss.

I. Steel - Galvanized:

1. One coat galvanize primer.
2. Two coats of alkyd enamel, semi-gloss.

J. Concrete Floors:

1. One coat of alkali resistant primer.
2. Two coats of alkyd floor enamel, gloss.

K. Gypsum Board:

1. One coat of latex primer sealer.
2. Two coats of latex enamel, eggshell.

L. Wall Surfaces Under Vinyl Wall Covering:

1. One coat of alkyd primer sealer.

M. Locker Rooms

1. Walls not covered with ceramic and behind lockers shall be painted.

    a) One coat of latex primer sealer.
    b) Two coats of latex enamel, semi-gloss.

N. Kitchen, Janitors Closet

1. One coat of latex primer sealer.
2. Two coats of latex enamel, semi-gloss.

END OF SECTION

SECTION 09955

VINYL COATED FABRIC WALL COVERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Wall covering.

1.2 RELATED SECTIONS

A. Section 09260 - Gypsum Board System: Wall substrate.

B. Section 09900 - Painting: Preparation and priming of substrate surfaces.

1.3 REFERENCES

A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM D2016 - Test Method for Moisture Content of Wood.

C. ASTM F793 - Classification of Wallcovering by Durability Characteristics.

D. FS L-P-1040 - Plastic Sheets and Strips, Polyvinyl Fluoride.

E. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.

F. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate wall elevations with seaming layout.

B. Product Data: Provide data on wall covering and adhesive.

C. Samples: Submit two samples of wall covering, 18 x 18 inch in size illustrating color, finish, and texture.

D. Test Reports: Submit reports verifying flame and smoke ratings, when tested by UL.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum [three] years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum years documented experience approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Conform to code for flame and smoke ratings of [25/50] when tested to ASTM E84.

1.7 FIELD SAMPLES

A. Provide field sample of wall covering on scheduled substrates.

B. Provide field sample panel, 2 feet wide, full height, illustrating installed wall covering, joint seaming technique.

C. Locate where directed.

D. Accepted sample may not remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the building site in original unopened containers. Materials shall be stored flat in a clean dry area with temperature maintained above 50 deg. F.

B. Inspect roll materials on site to verify acceptance.

C. Protect packaged adhesive from temperature cycling and cold temperatures.

D. Do not store roll goods on end.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or vinyl covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive wall covering.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Key Wallcovering

B. D.L. Couch

C. Genon

D. Product simular to vinyl wallcovering listed on drawings.

2.2 MATERIALS

A. Wall Covering: ASTM F793, Type 2; color selected from manufacturer's standard color range.

B. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

C. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

D. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply coverings unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.2 PREPARATION

A. Fill cracks and smooth irregularities with filler; sand smooth.

B. Sand glossy surfaces; seal marks which may bleed with shellac.

C. Remove electrical and telephone, wall plates and covers.

D. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

E. Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tight.

F. Horizontal seams are not acceptable.

G. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

H. Install wall covering before installation of bases, cabinets, hardware, or items attached to or spaced slightly from wall surface. Do not install wall covering more than 1/4 inch below top of resilient base.

I. Cover spaces above and below windows, above doors, in sequence from roll.

J. Apply fabric covering to electrical, telephone and wall plates prior to replacing.

K. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply covering with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.

L. Remove excess wet adhesive from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this Section.

3.5 PROTECTION OF FINISHED WORK

A. Do not permit work at or near finished wall covered areas.

END OF SECTION

SECTION 10105

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surfaced metal markerboards.

B. Map and display rail.

C. Trim, Chalkrail, and accessories.

1.2 RELATED SECTIONS

A. Section 09260 - Gypsum Board Systems: Substrate construction.

B. Section 06114 - Wood Blocking and Curbing: Wood grounds.

1.3 REFERENCES

A. AHA A135.4 - Basic Hardboard.

B. ASTM A424 - Steel Sheets for Porcelain Enameling.

C. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

D. ASTM B209 - Aluminum-Alloy Sheet and Plate.

E. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

F. ASTM C36 - Gypsum Wallboard.

G. ASTM C208 - Insulation Board (Cellulose Fiber) Structural and Decorative.

H. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

I. FS L-P-1040 - Plastic Sheets and Strips, Polyvinyl Floride.

J. HPMA HP - Hardwood and Decorative Plywood.

K. NPA A208.1 - Mat Formed Wood Particleboard.

L. PS 1 - Construction and Industrial Plywood.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate wall elevations, dimensions, joint locations.

B. Product Data: Provide data on markerboards, map and display rail, trim and accessories.

C. Samples: Submit two samples 6 x 6 inch (152 x 152 mm) in size illustrating materials and finish, color of markerboard and trim.

1.5 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include data on regular cleaning, and stain removal.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 WARRANTY

A. Warranty: Include coverage of markerboard surface from discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Claridge Products and Equipment, Inc. Product: LCS Writing System

B. Greensteel, 29 S. Laring Ave., Dixonville, PA Product: Dry Markerboard

C. Carolina Chalkboard, Landis, N.C. Product: Vitrasteel Dry Markerboard

2.2 MARKERBOARD MATERIAL

A. Sheet Steel: ASTM A526, galvanized to G90 designation.

2.3 CORE AND FRAME MATERIALS

A. Plywood: APA Structural I, Grade C-D birch species.

B. Foil Backing: Aluminum sheet, .015" thick.

C. Frame and Chalkrail: Aluminum extrusions, ASTM B221, 6061 alloy, temper.

2.4 ACCESSORIES

A. Adhesives: Type used by manufacturer.

B. Map Supports: Formed aluminum sliding hooks, to fit map rail.

C. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.

D. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near chalkrail.

2.5 FABRICATION - MARKERBOARDS

A. Outer Face Sheet: Steel, 24 gage thick.

B. Core: Plywood, 3/8 inch thick.

C. Backing Surface: Aluminum sheet, 0.015 inch thick.

D. Splice Joint: Concealed spline of sheet steel.

2.6 FABRICATION - DISPLAY RAIL (NO. 51 MAP AND DISPLAY RAIL)

A. Heavy gauge extruded aluminum with insert of 1/4 inch, (6 mm) thick. Provided with No. 51M display hook and map rail ends.

2.7 FABRICATION - FRAME AND TRIM

A. Aluminum Frame: Of straight profile; exposed fasteners, map rail with cork insert separate of markerboard and surfaces.

B. Aluminum Chalkrail: Of No. 263 profile, one piece full length of markerboard, open ends; exposed fasteners.

2.8 FINISHES

A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; White color.

B. Cork Surface: Natural light brown cork.

C. Aluminum Frame, Chalkrail, and Accessories: Mill finish natural aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

B. Verify flat wall surface for frameless adhesive applied type.

3.2 INSTALLATION

A. Install markerboards and map and display rail, in accordance with manufacturer's instructions.

B. Establish bottom of perimeter frame above finished floor by indications on drawings.

C. Secure units level and plumb.

D. Markerboards: Butt panels tight with concealed spline to hairline joint.

3.3 CLEANING

A. Clean markerboard surfaces in accordance with manufacturer's instructions.

B. Cover markerboard surfaces with protective cover, taped to frame.

END OF SECTION

SECTION 10160

TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid phenolic toilet compartments, floor mounted head rail braced.

B. Urinal screens; wall mounted with floor to ceiling pilaster brace.

1.2 RELATED SECTIONS

A. Section 09260 - Gypsum Board System: Framing and plates within walls.

B. Section 10800 - Toilet and Bath Accessories.

1.3 REFERENCES

A. ANSI A117.1 - Safety Standards for the Handicapped.

B. ASTM A167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM A424 - Steel Sheet for Porcelain Enameling.

D. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

E. FS RR-P-1352 - Partitions, Toilet, Complete.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Samples: Submit two samples of partition panel sheet, 12 x 12 inch in size illustrating panel finish, color, and sheen.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI A117.1 code for access for the handicapped.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.7 COORDINATION

A. Coordinate the work with placement of support framing and anchors in wall and ceiling.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Congress Pro-nolic by Capital Partitions, Inc.

B. Monarch Toilet Partitions, Inc.

C. Sanymetal Products Co.

2.2 MATERIALS

A. Panels: ½" thick solid phenolic core with decorative melamine surface on both sides.

B. Doors: 3/4" thick solid phenolic core with decorative melamine surface on both sides.

2.3 ACCESSORIES

A. Pilaster Shoe: Formed chromed steel with satin finish, ASTM A167 type 304 stainless steel with No. 4 finish, 3 inch high, with adjustable screw jack.

B. Head Rails: Hollow steel tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.

C. Attachments, Screws, and Bolts: Stainless steel; tamper proof type, heavy duty extruded aluminum brackets.

D. Hardware: Stainless steel:

1. Pivot hinges, gravity type, adjustable for door close positioning.
2. Nylon bearings.
3. Thumb turn door latch with exterior emergency access feature.
4. Door strike and keeper with rubber bumper.
5. Coat hook with rubber bumper.

6. Door pull for outswinging doors.

2.4 FABRICATION

A. Fabricate partitions in accordance with FS RR-P-1352.

B. Fabricate components of steel sheet as follows:

1. Panel and Door Faces: 20 gage.
2. Pilaster Faces: 18 gage.
3. Reinforcement: 12 gage.

C. Doors and Panels:

1. Thickness: 1 inch.
2. Door Width: 24 inch.
3. Door Width for Handicapped Use: 36 inch, out-swinging.
4. Height: 58 inch.

D. Pilasters: 1-1/4 inch (32 mm) thick, of sizes required to suit cubicle width and spacing.

E. Door, Panel, and Pilaster Construction: Sheet steel face, pressure bonded to sound deadening core, form and close edges, miter and weld corners, grind smooth.

F. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

2.5 FINISHING

A. Clean, degrease, and neutralize panels.

B. Follow immediately with a phosphatizing treatment, prime coat and two finish coats baked enamel.

C. Single Color: Color as selected from manufacturer's, standard colors.

D. Stainless Steel Surfaces: No. 4 finish.

E. Exposed Steel Surfaces: Satin stainless.

F. Non-ferrous Surfaces: Satin chrome plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attached panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets with [tamper proof] through bolts and nuts. Locate head rail joints at pilaster center lines.

E. Install 30 inch wide x 42 inch high stainless steel protective splash panels on partitions adjacent to urinals. Fasten with stainless steel screws spaced 8 inches.

F. Anchor urinal screen panels to walls with two panel brackets and vertical upright consisting of pilaster anchored to floor and ceiling.

G. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.

H. Support pilasters from built-in framing using two adjustable hanging studs providing vertical leveling. Conceal ceiling fastenings with pilaster shoe.

I. Equip each door with two hinges, one door latch, one coat hook and bumper.

J. Install door strike and keeper with door bumper on each pilaster in alignment with door latch.

K. Field touch-up of scratches or damaged enamel finish will not be permitted.

L. Replace damaged or scratched materials with new materials.

3.3 ERECTION TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10260

WALL AND CORNER PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45	(1980; R 1993) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D 256	(1993a) Determining the Pendulum Impact Resistance of Notched Specimens of Plastics
ASTM D 635	(1996) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 Manual	(1988) Metal Finishes Manual for Architectural and Metal Products

SOCIETY OF AMERICAN AUTOMOTIVE ENGINEERS (SAE)

SAE J1545	(1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Color Trim

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Wall Guards (Bumper Guards); GA.

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-04 Drawings

Wall Guards (Bumper Guards); GA.

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-13 Certificates

Corner Guards; [_____]. Wall Guards (Bumper Guards); GA.

Statements attesting that the items comply with specified fire and safety code requirements.

SD-14 Samples

Finish; GA.

Manufacturer's standard samples indicating color and texture of materials requiring color and finish selection.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 70 degrees F for at least 48 hours prior to installation.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 GENERAL

To the maximum extent possible, wall guards (bumper guards), shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Resilient material shall consist of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 18 ft. lbs/sq. inch when tested in accordance with ASTM D 256, (Izod impact, ft. lbs per sq inch notched).

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on

similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.2 NOT USED

2.3 WALL GUARDS (BUMPER GUARDS)

2.3.1 Wall Guards, Combination Handrail/Wall Guards and Handrails

Wall guards, combination handrail/wall guards, and handrails shall be provided with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. Extruded aluminum retainers shall conform to ASTM B 221, alloy 6063, temper T5 or T6. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards. Wall guards shall be profile as shown.

2.3.1.1 Wall Guards/Bed Locators

Wall guards shall consist of snap-on covers of high impact resistant resilient material, minimum 0.078 inch thick, mounted over 2 inch wide aluminum, minimum 0.062 inch thick retainer, anchored to wall at maximum 24 inches on center.

2.4 NOT USED

2.5 NOT USED

2.6 TRIM, FASTENERS AND ANCHORS

Vinyl trim, fasteners and anchors shall be provided for each specific installation as shown.

2.7 FINISH

2.7.1 Aluminum Finish

Finish for aluminum shall be in accordance with AA DAF-45. Concealed aluminum shall be mill finish.

2.7.2 Stainless Steel Finish

Finish for stainless steel shall be in accordance with NAAMM AMP 500 Manual, finish number 4.

2.7.3 Resilient Material Finish

Finish for resilient material shall be high gloss vinyl texture with colors selected by architect.

2.8 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.9 COLOR

Color shall be selected by architect from manufacturer's standard colors.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

-- End of Section --

SECTION 10440

SIGNS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior Signs

B. Dimensional letters and numbers

C. Exterior monument type sign.

1.2 RELATED SECTION

A. Section 03300 - Cast-In-Plate Concrete

B. Section 06200 - Finish Carpentry

C. Section 08111 - Std Steel Doors

D. Section 08211 - Flush Wood Door

E. Section 08800 - Glazing

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. AA 45 - 1980 Designation System for Aluminum Finishes

B. AA 46 - 1978 Anodized Architectural Aluminum

C. AAMA 605.2 - 1990 High Performance Organic Coatings on Architectural Extrusions and Panels

D. ANSI A10.3 - 1985 Powder-Actuated Fastening Systems - Safety Requirements

E. ANSI B18.2.1 - 1981 Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws

F. ANSI B18.6.1 - 1981 Wood Screws (Inch Series)

G. ANSI B18.6.2 - 1972 (R 1983) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws

H. ANSI B18.6.3 - 1972 (R 1983) Machine Screws and Machine Screw Nuts

I. ANSI B18.7 - 1972 (R 1980) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps

J. ASTM A 36/A 36M - 1989 Structural Steel

K. ASTM A 123 - 1989 (Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

L. ASTM A 153 - 1982 (R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

M. ASTM A 167 - 1990 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

N. ASTM A 525 - 1990 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

O. ASTM B 26/B 26M - 1988 Aluminum-Alloy Sand Castings

P. ASTM B 62 - 1990 Composition Bronze or Ounce Metal Castings

Q. ASTM B 108 - 1987 Aluminum-Alloy Permanent Mold Castings

R. ASTM B 209 - 1990 Aluminum and Aluminum-Alloy Sheet and Plate

S. ASTM B 221 - 1990 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

T. ASTM C 1036 -1990 Flat Glass

U. ASTM D 3841 - 1988 Glass-Fiber-Reinforced Polyester Plastic Panels

V. ASTM D 4802 - 1988 Poly (Methyl Methacrylate) Acrylic Plastic Sheet

W. AWS D1.1 - 1990 Structural Welding Code Steel, Twelfth Edition

X. FED-STD-795 - Uniform Federal Accessibility Standards

Y. FS FF-S-325 -(Int Am. 3) Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

Z. FS L-P-387 - (Rev. A) (Int Am. 2) Plastic Sheet, Laminated, Thermosetting (for Designation Plates)

AA. FS FF-P-395 - Rev. C) Pin, Drive Guided and Pin Drive, Powder Actuated (Fasteners for Powder Actuated and Hand

Actuated Fastening Tools)

AB. FS FF-B-588 - (Rev. D) Bolt, Toggle: and Expansion Sleeve, Screw

AC. FS GGG-D-777 - (Rev. B) Driver, Projectile Unit, Powder Actuated (High Velocity) (Above Water Only); Pin, Drive, Powder Actuated; and Cartridge, Powder Actuated Tool

AD. SAE AMS 3611 - 1986 (Rev. C) Plastic Sheet, Polycarbonate General Purpose

1.4 SUBMITTALS: Submit the following in accordance with Section 01300,"Submittals."

A. Manufacturer's Catalog Data:

1. Exterior wall sign.
2. Interior room and direction plaque signs
3. Building directories
4. Manufacturers standard color chart and ADA contrast analysis chart.

Submit complete detail drawings including elevations, templates, erection and installation details for products listed below. Indicate dimensions, construction details, reinforcement, anchorage, and installation with relation to the building construction. A schedule showing the location of each type of sign shall be included.

B. Shop Drawings:

1. Exterior wall signs
2. Interior room and direction plaque signs
3. Building directories

C. Certificates:

1. Aluminum sheet or plate
2. Aluminum castings
3. Cast bronze
4. Aluminum extrusions
5. Structural steel
6. Fiber-reinforced polyester
7. Glass
8. Acrylic sheet
9. Aluminum finishes

D. Samples:

1. Exterior letters.
2. Interior room, door, and direction plaque signs

3. Cutout letter for illuminated sign
4. Two samples of manufacturer standard color chips for each material requiring color selection. Take samples from manufacturer's stock complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.5 EXTRA STOCK

A. Provide 4 blank plaques of sign Type A. Submit prepaid coupon books for use by Owner for 100 each message strips for Directory and Window Sign Inserts.

1. Provide computer generated coupon books complete with Owner's name, address, message strip background color, type style, and type code imprinted on each coupon.

2. Provide completed message strip return to Owner from coupon book order within ten working days of receipt of coupon by manufacturer.

PART 2 PRODUCTS

2.1 ADA Compliant Signage with raised graphics and grade II braille.

2.2 Aluminum Alloy Products

A. ASTM B 209 for aluminum sheet or plate, ASTM B 221 for aluminum extrusions and ASTM B 26/B 26M or ASTM B 108 for aluminum castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 16 gauge thick. Provide aluminum castings of solid aluminum cast certified by AA 46 alloy designation B443.0. Where anodic coatings are specified, alloy shall conform to Aluminum Association's alloy designation 514.0 or A514.0.

B. Aluminum Finishes

1. Provide exposed aluminum surfaces factory finished with anodic coating .

a) Anodic Coating

2. Clean and provide exposed aluminum surfaces with an anodized finish, AA 45.

3. Integral color-anodized designation

AA-M10-C22-A42, Architectural Class I (0.7 mil or thicker). Color: as indicated.

C. Cast Metal

1. Fabricate with square corners, flat faces, and accurate profiles. Remove burrs and rough spots. Belt polish faces to uniform high luster finish. File sides smooth with tool marks removed by fine abrasive grain air blasting, or other suitable method.

a) Cast Aluminum - ASTM B 108.

D. Fiber Reinforced Polyester (FRP)

1. ASTM D 3841, Type II, Grade 1, color: as indicated.

E. Acrylic Sheet

1. ASTM D 4802, Type III.

2.3 VINYL SHEETING FOR GRAPHICS: Minimum 0.003 inch film thickness. Provide a pre-coated pressure sensitive adhesive backing, Class 1, or positionable pressure sensitive adhesive backing, Class 3.

2.4 EXPOSED ANCHORS AND FASTENERS: Compatible with sign material to which applied with matching color and finish. Protect against galvanic action or chemical interaction of adhesives.

A. Expansion Shields: FS FF-S-325, of Group, Type, Class, and Style suited for the purpose. Shields shall be recessed and shall be not less than 2 1/2 inches into concrete or masonry. Do not use devices of Groups IV, V, VI, and VII in sizes greater than 3/8 inch, unless so indicated.

B. Lag Screws and Bolts: ANSI B18.2.1.

C. Toggle Bolts: FS FF-B-588.

D. Bolts, Nuts, Studs, and Rivets: ANSI B18.2.1 or ANSI B18.7.

E. Powder Driven Fasteners: FS FF-P-395 or FS GGG-D-777. Provide only when permitted by ANSI A10.3. Follow safety provisions of ANSI A10.3.

F. Screws: ANSI B18.2.1, ANSI B18.6.1, ANSI B18.6.2, and ANSI B18.6.3.

2.5 FABRICATION AND MANUFACTURE

A. Workmanship: Drill or punch holes for bolts and screws. Drilling and punching shall produce clean, true lines and surfaces. Weld to structural steel in accordance with AWS D1.1. Weld continuously along entire area of contact. Grind exposed welds smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Conceal fastenings where practicable. Items specified to be galvanized shall be hot-dip galvanized after fabrication. Galvanize in accordance with ASTM A 123 or ASTM A 153 or ASTM A 525. Form joints exposed to the weather to exclude water. Include drainage and weep holes required to prevent build-up of condensation.

B. Dissimilar Materials: Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, protect surfaces with two coats of polyamidoamine epoxy primer: Hi-Build Epoxoline II, Series 69 - Tnemec at 3.0 mils to 5.0 mils dry film thickness (DFT) each coat and finish with one coat of Series 75 - Endura-Shield: Tnemec, at 2.0 to 5.0 mils DFT to prevent galvanic or corrosive action.

C. Shop Painting: Apply one coat of modified alkyd rust-inhibitive primer, Series 10 Tnemec, to surfaces of miscellaneous metal work, except non-ferrous metal, corrosion-resisting steel, and zinc-coated work. Do not paint surfaces of items to be embedded in concrete. Upon completion of work, thoroughly recoat damaged surfaces. Prime coat steelwork immediately after cleaning.

2.6 DIMENSIONAL LETTERS - EXTERIOR

A. Fabrication: Fabricate letters from cast aluminum. Clean letters by chemical etching or clean ultrasonically in a special degreasing bath using high frequency sound waves. Package letters to protect them until installation.

B. Style: Helvetica Medium

C. Size:

1. Height: As indicated on drawings.
2. Stroke: 2-1/2"
3. Depth: 3/4"
4. Average width: 10-1/4"

D. Color: Black anodized.

E. Mounting: Threaded studs at least 3/16 inch in diameter,

secured in quick-setting mortar, for concealed anchorage. Project letters 1-1/2 inch from the building line by stud spacer sleeves. Letters, studs, and sleeves shall be of the same material. Provide mounting and templates.

F. Finish: Provide anodized finish. Color: Bronze.

2.7 INTERIOR PLAQUE SIGNS

A. Holder

1. Material: Integrally colored injection molded high impact plastic complete with mounting system: ready for insert installation.
2. Type: Square corners indicated in Schedule. MOUNTING HOLDERS TO SURFACE; SELECT TYPE OR TYPES Wall Mounting: MFH: Hole type for fastener attachment to wall surface.
3. Mounting: Wall or vertical surface Fastening: MFH
4. Size: As indicated on the drawings.
5. Color: A44 - Architectural Brown.

B. Insert

1. Integrally colored injection molded high impact plastic with computer generated photographic silkscreen process surface printing chemically bonded to self-aligning reveal insert material; insert corner same type as holder. MOUNTING INSERTS INTO HOLDERS; SELECT TYPE OR TYPES: MTM; 1/32" thickness magnetic tape. Use when inserts are subject to frequent change. VTM; Double sided vinyl tape mounting. Use when insert mounting is permanent. PL; PresLock rigid plastic fastener. Allows removal of inserts with special tool.
2. Mounting: VTM.
3. Sizes: Indicated in Schedule from manufacturer's standard sizes.
4. Color: A44 - Architectural Brown.
5. Provide the following options indicated in Schedule:

    Split inserts.
    Changeable slide insert.
    Window sign insert module.
    Window sign.

C. Graphics Application:

1. Plaque Messages
2. Message content shall be as follows.
3. Typeface: Helvetica Medium
4. Type size: as indicated.

5. Background color: as indicated.
6. Message color: White

D. Mounting: Mechanical Fasteners: Provide mounting holes in plaques and mounting screws using molly-bolts as necessary to secure to vertical surface.

2.8 BUILDING DIRECTORIES

A. Type: Surface Mounted Non Illuminated Wall Hung Directory.

B. Type: 2300 Series Directory with message strips.

C. Size: Refer to Drawings.

D. Components: Housing:

1. Fabricated ASTM B221-90, 6063-T5 extruded aluminum alloy frame surrounding solid backing plate with PVC laminated to solid backing.
2. Color: #24 Wine.
3. Trim finish and color: AA M10C22A42 Duranodic Black 315.
4. Provide holes in back plate.

E. Doors:

1. Frame materials:
   Special: ASTM B455-89, extruded Alloy 385 architectural bronze, 0.125" thickness minimum; corners precision hairline mitered.
2. Door Profile: Square Accent Track suspended glass door.
3. Glazing:
   Optional: Optical quality E.I. du Pont de Nemours and Company, Inc; Lucite SAR 3/16" thickness super abrasion resistant clear acrylic plastic.
4. Hinges: Concealed continuous stainless steel hinge.
5. Furnish standard concealed keyless dual lock.
6. Finish and color: Alloy 280, Muntz metal C28000 Architectural Bronze.

F. Directory: Header Format:

1. Required. Architect will coordinate during shop drawing phase.
2. Type size: As specified.
3. Type style: OSB
4. Type code: Uppercase
5. Imprint color: #72 Bone White

G. Message Strips

1. 1/2" by 9" precision injection molded plastic strips with digital computer generated and photo silk-screened typography; provide sufficient blank strips to fill directory.
2. Type size: 1/4".
3. Type style: OSB.
4. Type code: Initial caps.
5. Integral strip color: #A65 Desert Rose.
6. Imprint color: #72 Bone White.
7. Provide strips with self-aligning reveal and flex and stack ability for ease of installation and removal.

H. Directory Unit Capacity:

1. Capacity:

a) Number of sides: one.

b) Number of message strips per column: 1/2" wide strip: 68.

I. Fabrication

1. Shop assembly:

a) Fabricate units to configurations indicated on reviewed shop drawings. Internally reinforce units in accord with reviewed shop drawings.

b) Provide copy required on reviewed shop drawings; fill all slots without specific copy with blank message strips.

J. Installation: Attach directories to supporting structures with concealed fasteners in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine condition of locations and surfaces on which signs will be installed. Do not proceed with installation until defects or errors which would result in poor installation have been corrected.

3.2 INSTALLATION

A. Install signs at locations as indicated. Ensure that signs are installed plumb and true, at mounting heights indicated, and by method shown or specified. to not install signs on doors or other surfaces until finishes on such surfaces have been applied.

1. Anchorage: Provide anchorage to ensure that signs are fastened securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Provide slotted inserts of types required to engage with anchors.

3.3 PROTECTION

A. Protect work and adjacent work and materials against damage during progress of work until completion. Wrap finished work with paper, polyethylene film, or strippable waterproof tape for shipment and storage and protect from damage during installation.

3.4 ADJUST AND CLEAN

A. Repair damage to signs incurred during installation. Replace signs which cannot be repaired to new condition. Clean glass, frames, and other sign surfaces, adjust hardware for proper operation.

PART 4 MANUFACTURERS

4.1 ACCEPTABLE MANUFACTURERS

A. ASI Sign Systems, Inc.
3890 W Northwest Huey
Dallas, TX 75220
1-800-ASI-SPEC

B. Interface International
5320 Webb Parkway
Lilburn, Georgia 30247
(404) 921-5566

C. Apco Graphics
388 Grant Street S.E.
Atlanta, Georgia 30312-2227
(404) 688-9000

END OF SECTION

SECTION 10508

METAL WARDROBE LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Locker units with hinged doors.

B. Metal tops, and filler panels.

C. Locker benches.

1.2 RELATED SECTIONS

A. Section 06114 - Wood Blocking and Curbing: Wood grounds and attachment strips.

1.3 REFERENCES

A. ASTM A446/A446M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

B. ASTM A526/A526M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

1.4 SUBMITTALS: Section 01300 - Submittals: Procedures for submittals.

A. Product Data: Provide data on locker types, sizes and accessories.

B. Shop Drawings: Indicate locker plan layout, numbering plan and key codes.

C. Samples: Submit two samples 3 x 6 inches in size, of each color selected; applied to specified base metal.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Transport, handle, store, and protect products.

B. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The Interior Medart Inc.

P. O. Box 658, Greenwood, MS 38930
Phone (800)647-7155 Model: Standard Lockers

B. List Industries, Inc. 401 N.W. 12th Ave.
Deerfield Beach, FL 33442
Phone (305) 429-9155 Model: Standard Lockers

C. Republic Storage System Co., Inc.
1038 Belden Ave., N.E., Canton, Ohio 44705
Phone (800) 447-1255 Model: Standard Lockers

2.2 MATERIALS

A. Sheet Steel: ASTM A446 Grade D, ASTM A526 Coating Designation G90, stretcher leveled; to the following minimum thicknesses:

1.	Body and Shelf:	24 gage
2.	Door Outer Face:	16 gage
3.	Door Inner Face:	20 gage
4.	Door Frame:	16 gage
5.	Hinges:	14 gage
6.	Base:	No Integral Base
7.	Sloping Top:	20 gage
8.	Trim:	20 gage

B. Locker size as indicated on the drawing for plan size, 72 inches high, single and double tier. Eyelet for padlock must accept a 5/16" padlock shank, providing a secured locking three point latching mechanism. Lockers will be sequentially numbered with a plate beginning with #1. Locker will contain a single shelf at top with handing rod and wall hooks on both sides. Louvers for circulation both at top and bottom.

2.3 ACCESSORIES

A. For Each All Metal, Quiet Type Wardrobe Locker: Two double prong wall hooks, coat hanger bar, rubber bumper.

B. Locker Benches: Stationary Free standing type; bench top of laminated maple species wood, stained, sealed and varnished; pedestals of chrome steel 17-1/2 inches (444.5 mm) high.

2.4 FABRICATION

A. Locker Units:
Configuration and size as previously indicated.

Mounting: Surface mounted.
Base: No Integral Base

Top:	Sloped metal with closures.
Ventilation Method:	Louvered top and bottom frame and top and bottom of door.
Class	Quiet

B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.

C. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

D. Doors: Hollow channel construction, 1 3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.

E. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.

F. Number Plates: Provide oval shaped aluminum plates. Form numbers ½ inch high of block font style, in contrasting color.

G. Provide ventilation openings at top and bottom of each locker.

H. Form recess for operating handle and locking device.

I. Finish edges smooth without burrs.

J. Fabricate sloped metal tops, ends and closure pieces.

K. Provide perforated end panels and filler strips.

2.5 FINISHES

A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel.

B. Paint locker bodies and doors in contrasting colors.

C. Color: As selected by Architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared bases are in correct position and

configuration.

B. Verify bases and embedded anchors are properly sized.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Secure lockers with anchor devices to suit substrate materials at floor and/or wall. Minimum Pullout Force: 100 lb.

D. Bolt adjoining locker units together to provide rigid installation.

E. Install end panels, filler panels, sloped tops, and bases.

F. Install accessories.

G. Replace components that do not operate smoothly.

H. Install benches with anchor devices to suite substrate material with minimum pullout force 100 lb.

3.3 CLEANING

A. Cleaning installed work.

B. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10522

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers and cabinets.

B. Accessories, including extinguishing brackets.

1.2 RELATED SECTIONS

A. Section 06114 - Wood Blocking and Curbing: Wood blocking and shims.

B. Section 09260 - Gypsum board System: Roughed-in wall openings.

C. Section 09900 - Painting: Field paint finish.

1.3 REFERENCES

A. ANSI/NFPA 10 - Portable Fire Extinguishers.

B. ANSI/UL 92 - Fire Extinguisher and Booster Hose.

C. ANSI/UL 711 - Rating and Fire Testing of Fire Extinguishers.

D. UL 299 - Dry Chemical Fire Extinguishers.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and location.

B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.6 QUALITY ASSURANCE

A. Provide units conforming with ANSI/UL 711.

1.7 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 10 for requirements for extinguishers.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. J. L. Industries, 4450 W. 78th St. Circle
Bloomington, MN 55435, phone 612-835-6850
product: Fire Extinguisher Cabinets

B. Larsen's Manufacturing Company
7421 Commerce Lane N.E.
Minneapolis, MN 800-527-7367
Product: Fire Extinguisher Cabinets

C. Potler-Roemer, 16833 Edwards Rd.,
Cerritos, CA 90701-2417
310-404-3753
Product: Fire Extinguisher Cabinets

2.2 CABINETS

A. Metal: Formed sheet steel, primed galvanized; 18 gage thick base metal.

B. Configuration: Semi-Recessed type, sized to accommodate accessories exterior nominal dimensions of 15-1/2 inch wide x 30-1/2 inch high x 9 inch deep.

C. Trim Type: Rolled edge.

D. Door: 18 gage thick, reinforced for flatness and rigidity; full glass style.

E. Door Glazing: Glass, clear, 1/8 inch thick float tempered.

F. Cabinet Mounting Hardware: Appropriate to cabinet.

2.3 ACCESSORIES

A. Extinguisher Brackets: Formed steel, white enamel finish.

B. Cabinet Signage: Fire Extinguisher.

2.4 FABRICATION

A. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

B. Pre-drill for anchors.

C. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon roller type catch.

D. Weld, fill, and grind components smooth.

2.5 FINISHES

A. Cabinet Exterior Trim and Door: Baked enamel, color as selected.

B. Cabinet Interior: Baked enamel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, located from finished floor as indicated on the architectural drawing.

C. Secure rigidly in place.

D. Position cabinet signage on door to cabinets.

END OF SECTION

SECTION 10550

POSTAL SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Mail chutes.
2. Horizontal mailboxes.

B. Related Sections include the following:

1.3 SUBMITTALS

A. Product Data: For each type of postal specialty specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

1. Provide manufacturer's certification that equipment proposed complies with USPS regulations and has been approved by the Postmaster General.

B. Shop Drawings: For each type of postal specialty specified. Show details of fabrication and installation. Include plans, elevations, sections, and attachments to other work.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes of exposed materials and accessories available for each type of postal specialty indicated.

D. Samples for Verification: Full-size units of each type of exposed color and finish required for each type of postal specialty specified. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain mail chutes and receiving and collection boxes through one source from a single manufacturer to ensure that mail will flow without restriction from the chute into the box.

B. Where mail system is served by USPS, provide products approved by USPS.

C. Requirements of Regulatory Agencies: Comply with USPS requirements for construction and installation of units served by USPS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mail Chutes:

    a. Cutler Manufacturing Corporation.
    b. Meta-Lite, Inc.
    c. U.S. Chutes Corp.
    d. Salsbury Industries.

2. Horizontal and Vertical Mailboxes:

    a. American Device Manufacturing Company.
    b. Auth-Florence Manufacturing Company.
    c. Bommer Industries, Inc.
    d. Cutler Manufacturing Corporation.
    e. Jensen Industries (horizontal only).
    f. Meta-Lite, Inc.
    g. Salsbury Industries.
    h. U.S. Chutes Corp.

2.2 METALS

A. Aluminum: Alloy and temper best suited for the intended use and finish indicated.

1. Plate and Sheet: ASTM B 209 (ASTM B 209M), mill finish, where not exposed.
2. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M).

B. Bronze: CDA copper alloy of type and form indicated to comply with the following:

1. Extruded Shapes: ASTM B 455, alloy UNS No. C38500

(architectural bronze).
2. Plate and Sheet: Alloy UNS No. C22000, C23000, or C28000.

C. Stainless Steel: Austenitic stainless-steel sheet or plate complying with ASTM A 666, Type 302 or 304.

D. Steel: Cold-rolled steel sheet or plate, zinc-coated by electrodeposition, galvanized, or conversion coated for application of manufacturer's standard factory-applied, baked-enamel finish.

2.3 MAIL AND PACKAGE DROP

A. General: Provide manufacturer's standard mail and package drop to suit indicated project installation. Unit to include a door hopper and a theft guard.

B. Material: 20 ga. steel.

C. Size: 16 ½" W x 25 ½" H x 15 1/4" D
Mail Slot: 11" W x 5/8" H
Package Drop: 15 1/4" W x 7".

D. Finish: Finish exposed-to-view surfaces as follows:

1. Powder-coated white.

2.4 HORIZONTAL MAILBOXES

A. General: Provide horizontal-type mailboxes complying with USPS Publication 17 in size and with features indicated.

B. General: Provide horizontal-type mailboxes in size and with features indicated.

C. Rear-Loading Door: Manufacturer's standard unit with solid closure and positive-latching mechanism.

D. Mail Compartments and Wall Receptacles: Fabricate concealed components of units from manufacturer's standard aluminum or steel sheet. Equip each compartment to receive tenant's name card.

E. Compartment Doors and Trim: Fabricate doors and trim from extruded aluminum to suit type of installation and loading method.

1. Identification: Plastic tabs with heat-stamped numbers on each door, as designated by Architect. For sorting, provide slots and clear plastic openings to receive tenants' name cards.

2. Locking: Manufacturer's standard single-dial, 3-digit, combination locks. Deliver manufacturer's record of combinations to Owner.

F. Steel Finish: Manufacturer's standard baked-enamel finish in color selected by Architect from manufacturer's full range of colors.

2.5 METAL FINISHES

A. Steel Finish: Baked enamel in color selected by Architect from manufacturer's full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine mailroom areas and conditions for compliance with clearances and roughing-in requirements affecting installation of postal specialties. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. In addition to requirements of these Specifications, comply with manufacturer's written instructions and recommendations for preparing substrates, installing anchors, and applying postal specialty units.

3.3 INSTALLATION

A. Install postal specialties level and plumb, according to manufacturer's written instructions, roughing-in drawings, original design, and referenced standards.

1. Final acceptance depends on compliance with USPS requirements.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure postal specialties are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10550

SECTION 10552

METAL STORAGE SHELVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal storage shelving.

1.2 RELATED SECTIONS

A. Section 09650 - Resilient Flooring: Substrate for metal storage shelving.

B. Section 03300 - Cast-In-Place Concrete.

1.3 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Submit shop drawings showing location, ranges and extent of metal shelving systems. Show installation details at any special or non-standard conditions.

B. Samples:

1. Initial Selection Purposes: Submit manufacturer's standard size samples of colors and finishes.
2. Verification Purposes: Submit 6" square samples of each color and finish required. Prepare from same material to be used for the work.

C. Seismic Calculations: Submit detailed calculations of seismic forces for fully loaded shelving, indicating compliance with seismic design requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (material producer) with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer Qualifications: Firm specializing in metal storage shelving installation with not less than 2 years of experience in installation of metal storage shelving similar to that required for this project.

C. Single Source Responsibility: Provide material produced by a single manufacturer for each shelving unit type.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.6 WARRANTY

A. Special Project Warranty: Submit a written warranty, executed by the Contractor, Installer and the Manufacturer, agreeing to repair or replace shelving units which fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the Government may have against the Contractor under the Contract Documents.

1. Warranty period is 2 years after the date of Substantial Completion.

1.7 MAINTENANCE

A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and methods which may be detrimental to finishes and performance.

B. Replacement Materials: After completion of work, deliver not less than 2 of each type, color, and pattern of metal storage shelving, exclusive of material required to properly complete installation. Furnish 2% of accessory components as scheduled. Furnish replacement materials from same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

Penco Products Inc.
Republic Storage Systems Co., Inc.

2.2 MATERIALS

A. General: Minimum 20 gauge cold-rolled steel sheet metal,

washed to receive powder coated baked enamel finish, higher gauge where indicated to provide appropriate loading capacity.

B. Open Shelving: Provide heavy-duty open shelving units consisting of four upright corner pilasters, slotted to receive clips clipped together with shelves as indicated. Provide cross-braces laterally and at ends as required for stability with intended load. Shelves adjustable 1-1/2" on center. Provide 36" and 48" wide by 87" high units, unless otherwise indicated on drawings or in specifications.

C. Shelf Depth: Provide shelving of standard depth as follows:

Standard Shelf Depth: 24"

D. Unit Configuration: Provide shelf units in configuration as follows:

E. Standard Upright Assembly: provide complete unit equipped with four uprights; shelves and top designed to stand independently.

F. Shelves: Provide units with number of shelves as indicated.

G. Lateral Cross Braces: Minimum 12 gauge, 1" wide steel band, formed and punched at each end, capable of bolting to T sections. provide one pair of cross braces for every three sections of under 30"; two pairs for every two sections 30" and over.

H. Crosswise Dividers: Minimum 24 gauge steel for shelves up to 18" high and 24" deep, minimum 20 gauge steel for shelves over 18" high and 24" deep, punched for attaching to shelves.

I. Lengthwise Dividers: Steel gauge as required by shelf spacing.

J. Bases: Channel-shaped to engage upright T sections with spring fasteners, minimum 20 gauge for 3" base, minimum 18 gauge for 6" base.

2.3 FINISHES

A. Provide units in finishes and colors as selected by Architect from manufacturer's standard finishes and colors.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect areas and conditions in which metal storage shelving will be installed. Verify locations of power feeds, positioning of exits and aisle ways and overall dimensions of space, including height and HVAC venting.

3.2 PREPARATION

A. Prior to installation of shelving system, vacuum floor surface to remove dust, debris and loose particles. Resilient flooring wet mopped and dried or finish buffed. Verify that components, including size and finish are those specified before installing.

3.3 INSTALLATION

A. Install shelving system and accessories after finishing operations, including painting have been completed. Install system to comply with final layout drawings, in strict compliance with manufacturers printed instructions. Position units level, plumb; at proper location relative to adjoining units and related work. Adjust accessories to provide visually acceptable installation.

3.4 FIELD QUALITY CONTROL

A. Remove and replace shelving components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.5 ADJUST

A. Adjust components and accessories to provide visually acceptable installation.

3.6 CLEANING

A. Immediately upon completion of installation, clean components and surfaces following manufacturer's recommended procedures.

B. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

3.7 DEMONSTRATION

A. Upon completion of installation of system, inspect and determine capability and compliance with requirements. Repair or replace units which are not functional. All shelves and/or accessories shall be smoothly in place with no visual buckling or non-alignment of parts evident.

3.8 PROTECTION

A. Protect system against damage during remainder of construction period. Advise owner of additional protection needed to ensure that system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 10605

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wire mesh system for walls and ceiling.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.

B. Division 9 - Finishes.

1.3 REFERENCES

A. ASTM A36 - Structural Steel.

B. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

E. ASTM A446 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural (Physical Quality).

F. ASTM A500 - Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

G. ASTM A501 - Hot-formed Welded and Seamless Carbon Steel Structural Tubing.

H. ASTM A510 - General Requirements For Wire Rods and Course Round Wire, Carbon Steel.

I. ASTM A580 - Stainless and Heat-Resisting Steel Wire.

J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

K. ASTM B211 - Aluminum-Alloy Bars, Rods, and Wire.

L. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

M. AWS D1.1 - Structural Welding Code.

N. SSPC (Steel Structures Painting Council) - Painting Manual.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. SD-04 Shop Drawings

Wire Mesh Partitions; GA.

Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, framed openings, anchorage, welds, type and location of fasteners, and accessories or items required of related work.

B. SD-01 Product Data

Wire Mesh Partitions; GA.

Mesh Partition Screen; GA.

Hardware; GA.

Provide data for screen materials, finishes, and hardware.

C. SD-14 Samples

Wire Mesh Partition; GA.

Accessories; GA.

Submit two samples, 12" x 12" in size illustrating screen material. Submit samples of hinge latchset illustrating style, color, and finish.

Installation Instructions; FIO.

Indicate special procedures, perimeter conditions requiring special attention.

D. SD-08 Statements

Qualifications; FIO.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Acorn Wire and Iron Works, Inc.
The G-S Company
Hoosier Fence Co., Inc.
Indiana Wire Products, Inc.
Kentucky Metal Products Co.
King Wire Partitions Inc.
Lakeside Wire and Iron Co.
Miller wire Works, Inc.
Wire and Iron Products, Inc.

2.2 HEAVY DUTY MESH PARTITIONS

A. Mesh: 10-gage crimped steel wire woven into 1-1/2-inch diamond mesh, securely clinched to frame members.

B. Frames: Provide cutouts for pipes, ducts, beams, and other items shown or necessary for partition installation. Finish edges of cutouts to provide a neat, protective edge.

C. Frame Members: 1-1/4 inch by 5/8 inch cold rolled steel channels, conforming to ASTM A36, with 3/8 inch bolt holes approximately 18 inches o.c.

D. Horizontal Reinforcing Members: 1-1/2 inch by 3/4 inch by 1/8 inch cold rolled steel channel with wire woven through, or two 1-inch by 1/2 inch channels bolted or riveted toe-to-toe through the mesh and secured to vertical members. Provide number of horizontal reinforcing members to suit panel height as recommended by partition manufacturer.

E. Stiffening Bars: Provide flat bar stiffener posts between all abutting panel frames. Size as recommended by partition manufacturer for partition height required. Increase size of stiffening bars if required to maintain partition rigidity.

F. Top Capping Bars: 3 inch by 4.1 pound channel secured to

top framing members with 1/4 inch "U" bolts spaced not more than 28 inches o.c.

G. Line Posts: Where partition runs exceed 20 feet without intersection or connection to overhead framing, furnish 3 inch by 4.1 pound channel line posts with 5 inch by 18 inch by 1/4 inch base plates located at recommended intervals to ensure partition rigidity and stability.

H. Floor Shoes: Cast metal, sized to suit vertical framing and to provide approximately 3 inches clear space between finished floor and bottom horizontal frame members. Furnish units with set screw for leveling adjustment.

2.3 DOORS

A. Hinged Door: Door frame of 1-1/2" x 3/4" channel with 1-1/2 x 1/8" flat bar cover three sides. 1-5/8" x 7/8" x 1/8" angle riveted to lock side. Refer to 08700 Builder’s Hardware for Cage Door Hardware.

B. Cylinders for locks are specified in Section 08700.

2.4 WINDOW GUARDS

A. Horizontal Reinforcing Members: Two 1 inch by 3/8 inch channels riveted toe-to-toe through the mesh and welded to vertical members. Provide number of horizontal reinforcing members to suit panel height as recommended by partition manufacturer.

B. Anchorage Devices: Furnish appropriate types and quantities of anchorage devices to provide adequate anchorage to adjacent structures.

2.5 FABRICATION

A. Do not use components less than sizes indicated. Use larger size components as recommended by partition component manufacturer.

B. Provide bolts, hardware, and accessories for complete installation.

C. Finish: Manufacturer's standard shop-applied enamel finish. Provide manufacturer's standard finish color.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings,

diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

A. Erect partitions plumb, rigid, properly aligned, and securely fastened in place, complying with drawings and manufacturer's recommendations.

B. Provide additional field bracing as shown or necessary for rigid, secure installation. Erector to provide additional clips and bracing as required.

C. Installation: All bolts shall be welded or peened to eliminate removal of nuts.

3.3 ADJUST AND CLEAN

A. Adjust moving components for smooth operation without binding.

B. Touch-up damaged finish after completion of installation using field-applied paint to match color of shop-applied finish.

END OF SECTION

SECTION 10753

WALL-MOUNTED TELEPHONE ENCLOSURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall-mounted telephone enclosures.

1.2 RELATED SECTIONS

A. Section 09260 - Gypsum Board System.

B. Section 09900 - Painting.

1.3 REFERENCES

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

A. AAMA 603.8: Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

AMERICAN NATIONAL STANDARDS INSTITUTE

B. ANSI A117.1: Specifications for Making Buildings and Facilities Accessible to and Useable by Physically Handicapped People.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

C. ASTM A 167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickle Steel Plate, Sheet, and Strip.

D. ASTM A 366: specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

E. ASTM A 525: Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

F. ASTM A 526: Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

G. ASTM A 568: Specification for General Requirements for Steel, Carbon and High-Strength Low-Alloy Hot-Rolled Sheet and Cold Rolled Sheet.

H. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

I. ASTM B 221: Standard specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.

J. ASTM C 1048: Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.

K. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

L. ASTM D 1003: Test Method for Haze and Luminous Transmittance of Transparent Plastics.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

M. NEMA LD 3: High Pressure Decorative Laminates.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate location and anchorage detail of telephone enclosures to wall construction.

B. Product Data: Provide construction data on telephone enclosures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers offering equivalent products.
1. American Specialties, Inc. - Product: Tellette 1310-SH
2. Phillip & Brooks, Inc. - Product: PB-101/Indoor Enclosure
3. Redy Ref Pressed & Welded, Inc. - Product: MS 2200-CF

2.2 MATERIALS

A. Stainless steel plate, sheet and strip: Provide stainless steel plate, sheet, or strip, A151 type 302 or 304.

Comply with requirement of ASTM A 167.
1. Perforated panels: Provide panels with not less than 1000 perforations per square foot for acoustical panels.
2. Acoustical Material: Provide non-flaking or enamel glass fiber sound absorption blankets or boards.

2.3 WALL-MOUNTED, SHELF TYPE TELEPHONE ENCLOSURES

A. General: Provide wall mounted, shelf type telephone enclosure units of the style indicated.
1. Provide groupings of enclosures with a common divider wall between adjacent units.

B. Enclosure Body: Provide surface-mounted, shelf-type telephone enclosures of the size and style indicated. Enclosures shall consist of an acoustic rear wall panel containing the telephone instrument, side walls, and a writing shelf.
1. Side Walls: Stainless steel acoustic panels.
2. Shelf: Full-length stainless steel writing shelf.

2.4 ACCESSORIES

A. Telephone Type: Bell Type 1 standard box-type, coin-operated telephone instrument.

B. Inserts and Anchorages: furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of units. Coordinate delivery of inserts and anchoring devices with other work to avoid delaying installation.

C. Fasteners: provide screws, bolts, and other exposed fastening devices of the same material as the items being fastened. Fasteners for application on the exterior and exposed to the weather may be hot-dip galvanized, stainless steel, or aluminum. Provide types, gages, and lengths to suit installation conditions. Use theft-proof fasteners where exposed to view.

2.5 FABRICATION

A. Construction: Fabricate telephone enclosures to requirements indicated. Provide units square, rigid, and without warp, with metal edges flat and free of dents or distortion. Make exposed metal edges safe to touch. Weld members together to firm a rigid one-piece structure. Grind exposed welds flush.

B. Shop Assembly: Preassemble telephone enclosures in the

shop to the greatest extent possible, to minimize assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

2.6 FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
   1. Stainless Steel Finishes: Finish designations prefixed by "AISI" conform to the system established by the American Iron and Steel Institute for designating finishes.
      a. Bright, Directional Polish Finish: AISI Type 302 or 304 with No. 4 directional polish finish.
         1) Grain Direction: Horizontal

PART 3 EXECUTION

3.1 INSTALLATION

A. Install telephone enclosures and related accessories at locations shown in accordance with manufacturer's instructions. Provide clips, grounds, backing materials, brackets and anchors, trim and accessories necessary for a complete installation.

3.2 ADJUST AND CLEAN

A. Replace units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended by the manufacturer.

END OF SECTION

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Toilet, bath shower and washroom accessories.

B. Grab bars.

C. Attachment hardware.

1.2 RELATED SECTION

A. Section 09111 - Metal Stud Framing System: In wall framing and plates for support of accessories.

B. Section 10160 - Metal Toilet Compartments.

1.3 REFERENCES

A. ANSI A117.1 - Safety Standards for the Handicapped.

B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

E. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

F. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

G. NEMA LD-3 - High Pressure Decorative Laminates.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

B. Samples: Submit two samples of each component, illustrating color and finish.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special

attention, and anchorage.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI A117.1 code for access for the handicapped.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on product data.

1.7 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bobrick Washroom Equipment, Inc. Product Bobrick

B. Bradley Corporation Product Bradley

C. American Specialties

2.2 MATERIALS

A. Sheet Steel: ASTM A366.

B. Stainless Steel Sheet: ASTM A167, Type 304.

C. Tubing: ASTM A269, stainless steel.

D. Adhesive: Two component epoxy type waterproof.

E. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, and security type.

F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

A. Weld and grind joints of fabricated components, smooth.

B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.

C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1.5 inches clear of wall surface.

D. Shop assemble components and package complete with anchors and fittings.

E. Provide steel anchor plates, adapters, and anchor components for installation.

2.4 KEYING

A. Master key all accessories.

2.5 FINISHES

A. Galvanizing: ASTM A123 to 1.25 oz/sq yd (380 g/sq m). Galvanize ferrous metal and fastening devices.

B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

C. Stainless Steel: No. 4 satin luster finish.

D. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify exact location of accessories for installation.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.

B. Install plumb and level, securely and rigidly anchored to substrate.

3.4 SCHEDULE

A. AC-1, Mop and Broom Holder, (ASI Model 1318, Bradley Model 9986 Bobrick Model B-224) - Strip shall be constructed of 16 gauge Type 302 (18-8) stainless steel no. 4 satin finish. Strip shall be formed with a return flange to the wall on top and a returned flange to the wall at the bottom. Holder pieces shall be constructed from molded resilient rubber with ribbed gripping surface. Strip shall be 48" long with 6 holders.

B. AC-2, Polished Stainless Steel Mirror (ASI Model 0600-C, Bradley Model 780-2460, Bobrick Model 2906, 24" x 36"). Mirror shall be framed with one-piece, type 304, stainless steel angle, 3/4" x 3/4" with continuous integral stiffener on all sides and beveled edge to hold frame tightly against mirror. Corners shall be heliarc welded, ground and polished smooth. All exposed surfaces shall be satin finish. Mirror shall be polished stainless steel. All edges shall be protected by high impact plastic filler strips. Back of mirror shall be protected by shock-absorbing, waterproof, non-abrasive 1/4" thick polystyrene padding. Galvanized steel back shall have integral hanging brackets for mounting on concealed rectangular wall hanger(s) and be secured with concealed Phillips-head locking screws in lower frame.

C. AC-7, Recessed Paper Towel Dispenser and Waste Receptacle (ASI Model 0462 AD, Bradley Model 2291, Bobrick Model No. B-369). Recessed paper towel dispenser and waste receptacle shall be constructed entirely of Type 304 stainless steel, welded construction with exposed surfaces satin finish. Flange shall be drawn one-piece seamless construction. Door shall be double pan construction and equipped with a knob latch. Door shall be secured to cabinet with full-length stainless steel piano hinge. Paper Towel Dispenser shall be capable of dispensing 350 C-fold or 475 Multifold paper towels without use of adapters. Waste receptacle, removable for servicing, with top edges hemmed for safe handling, shall have a capacity of 2 gallons (7.6 liters).

D. AC-8, Surface Mounted Paper Towel Dispenser and Waste Receptacle (ASI Model 0462ADSM, Bradley Model 2291-11, Bobrick Model No. B-3699). Surface Mounted Paper Towel Dispenser and Waste Receptacle shall be constructed entirely of type 304 stainless steel, all welded construction with exposed surfaces satin finish. Flange shall be drawn one-piece seamless construction. Door shall be double pan construction and equipped with a knob latch. Door shall be secured to cabinet with full-length

stainless steel piano hinge. Paper Tower Dispenser shall be capable of dispensing 350 C-fold of 475 Multi-fold paper towels without use of adapters. Waste receptacle, removable for servicing, with top edges hemmed for safe handling, shall have a capacity of 2 gallons (7.6 liters).

E. AC-11, 1-1/2-inch (38mm) Diameter Stainless Steel Grab Bars With Concealed Mounting (ASI 3201-36, Bradley 812-001-36, Bobrick Model B-6206 x 36" in length). Grab bar shall be constructed of type 304 stainless steel with satin finish. It shall have wall thickness of 18 gauge (1.2 mm) and outside diameter of 1-1/2" (38 mm). Distance from inside of grab bar to finished wall shall be 1-1/2" (38 mm). Flanges shall be 11 gauge (3.2 mm) stainless steel, 3" (76 mm) diameter and each shall have 4 stainless steel set screws. Ends of grab bar shall pass thru flanges and be heliarc welded to form one structural unit. Concealed mounting plates shall be 13 gauge (2.3 mm) stainless steel with 3 slotted screw holes.

F. AC-12, 1-1/2 inch Diameter All Stainless Steel Grab Bar (ASI Model 3201-42, Bradley 812-001-42, Bobrick Model B-6206 x 42" in length). Grab bar shall be constructed of type 304 stainless steel with satin finish. It shall have wall thickness of 18 gauge (1.2 mm) and outside diameter of 1-1/2" (38 mm). Distance from inside of grab bar to finished wall shall be 1-1/2" (38 mm). Flanges shall be 11 gauge (3.2 mm) stainless steel, 3" (76 mm) diameter and each shall have 4 stainless steel set screws. Ends of grab bar shall pass thru flanges and be heliarc welded to form one structural unit. Concealed mounting plates shall be 13 gauge (2.3 mm) stainless steel with 3 slotted screw holes.

G. AC-13, Stainless Steel Utility Hook (ASI Model 7340-S, Bradley Model 9115, Bobrick Model B-670). Utility Hook shall be constructed entirely of type 304 stainless steel.

H. AC-14, Stainless Steel Toilet Paper Holder (ASI Model 7305-S, Bradley Model 5084, Bobrick Model B-6857). Toilet Paper Holder shall be constructed entirely of type 304 stainless steel with satin finish. Support arm and flange shall be equipped with concealed 16 gauge mounting bracket which locks to concealed stainless steel wall plate with stainless steel set screw. Roller shall be chrome-plated plastic, with heavy duty internal spring.

I. AC-15, Surface (Wall) Mounted Waste Receptacle (ASI Model 0828, Bradley Model 357, Bobrick Model B-279). Wall mounted waste receptacle shall be constructed entirely of 18-8, type 304, 22 gauge stainless steel with all exposed

surface satin finish. Waste receptacle shall have a capacity of more than 6.7 gallons and vinyl liner shall be furnished as standard.

J. AC-16, Recessed Waste Receptacle for 3" Wall (ASI Model 0458A, Bradley Model 344, Bobrick Model B-3645). Recessed waste receptacle shall be constructed entirely of stainless steel, all welded construction. Flange shall be drawn one-piece seamless construction. Exposed surfaces shall have satin finish. Cabinet shall be equipped with a tumbler lock that secures waste container. Waste container shall be removable for servicing and have a capacity of more than 1.5 cu. ft.

R. AC-18, Double-coin Recessed Napkin/Tampon Vendor (Bobrick Model B-3500X2; Bradley 401 and ASI 0464 Recessed napkin/tampon vendor shall combine two dispensing mechanisms in one cabinet to provide napkins or tampons at user's option. Dispensing mechanisms shall be convertible to allow the change of coin denomination without purchasing new mechanisms or removing unit from wall. Unit shall be type 304 stainless steel with all-welded construction. Cabinet shall be 22 gauge (0.8 mm). Door shall be 18 gauge (1.2mm); exposed surfaces shall have satin stainless steel finish. Door shall have 7/8" (22mm) 90 degree return edges; be secured to cabinet with a concealed, full-length, stainless steel piano-hinge; and equipped with a stainless steel cable doorstop and two tumbler locks. Each coin box shall be equipped with a tumbler lock that is keyed differently than door locks. Unit shall carry no brand-name advertising. Unit shall be equipped with double-coin mechanisms in the amount to be determined by the Government.

S. AC-19, Surface-Mounted Napkin/Tampon Vendor (Bobrick Model B-2800X2; Bradley 426 and ASI 0864) Surface-mounted napkin/tampon vendor shall combine two dispensing mechanisms in one cabinet to provide napkins or tampons at user's option. Dispensing mechanisms shall be convertible to allow the change of coin denomination without purchasing new mechanisms or removing unit from wall. Unit shall be type 304 stainless steel with all welded construction; exposed surfaces shall have satin finish. Door shall be 18 gauge (1.2mm) and have 7/8" (22mm) 90 degree return edges; be secured to cabinet with a concealed, full-length, stainless steel piano-hinge; and equipped with a stainless steel cable doorstop and two tumbler locks. Each coin box shall be equipped with a tumbler lock that is keyed differently than door locks. Unit shall carry no brand name advertising. Unit shall be equipped with double-coin mechanisms in the amount to be determined by the Government.

T. AC-20, Surface-Mounted Sanitary Napkin Disposal: ASI Model 0852, Bradley Model 4781-15, Bobrick Model B-270.

NOTE: All grab bar installation shall withstand forces in excess of 300 lbs. All components and installation shall conform with the latest requirements.

U. AC-21, Surface-Mounted Toilet Seat Cover and Toilet Tissue Dispenser: (ASI Model 0486 Bradley Model 5922, Bobrick Model No. B-3479) surface mounted toilet seat cover and toilet tissue dispenser shall be constructed entirely of Type 304 stainless steel, all welded construction with exposed surfaces satin finish. Flange shall be drawn-one piece seamless construction. Door shall be drawn one-piece seamless construction secured to cabinet with full-length stainless steel piano-hinge. Toilet-tissue dispenser equipped with two theft-resistant heavy duty one piece molded polyethylene spindles. Toilet seat cover dispenser to hold 1000 single or half folded paper covers.

V. AC-22, Partition-Mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser: (ASI Model 0481, Bradley Model 5911, Bobrick Model No. B-357) surface mounted toilet seat cover and toilet tissue dispenser shall be constructed entirely of Type 304 stainless steel, all welded construction with exposed surfaces satin finish. Flange shall be drawn-one piece seamless construction. Door shall be drawn one-piece seamless construction secured to cabinet with full-length stainless steel piano-hinge. Toilet-tissue dispenser equipped with two theft-resistant heavy duty one piece molded polyethylene spindles. Toilet seat cover dispenser to hold 1000 single or half folded paper covers.

Waste receptacle to be made of leak proof molded polyethylene and be removable for service.

W. AC-23, Surface-Mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser: (ASI Model 0483, Bradley Model 5912-11, Bobrick Model No. B-3579) surface mounted toilet seat cover dispenser, sanitary napkin disposal and toilet tissue dispenser shall be constructed entirely of Type 304 stainless steel, all welded construction with exposed surfaces satin finish. Flange shall be drawn-one piece seamless construction. Door shall be drawn one-piece seamless construction secured to cabinet with full-length stainless steel piano-hinge. Toilet-tissue dispenser equipped with two theft-resistant heavy duty one piece molded polyethylene spindles. Toilet seat cover dispenser to hold 1000 single or half folded paper covers.

Waste receptacle to be made of leak proof molded polyethylene and be removable for service.

END OF SECTION

SECTION 11133

PROJECTION SCREENS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Projection screens, factory framed.

1.2 Related Sections:

A. Section 06114 - Wood Blocking and Curbing.

B. Section 09111 - Metal Stud Framing System.

C. Section 09260 - Gypsum Board System.

1.3 REFERENCES

A. American Architectural Manufacturers Association

1. AAMA 606.1: Voluntary Guide specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
2. AAMA 607.1-1977: Voluntary Guide Specification and Inspection Methods for Integral Clear Anodic Finishes for Architectural Aluminum.
3. AAMA 608.1-1977: Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

B. American Society for Testing and Materials:

1. ASTM B 221-90: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
2. ASTM C 1036-90: specification for Flat Glass.
3. ASTM D 1003-61 (1988): Test Method for Haze and Luminous Transmittance of Transparent Plastics.
4. ASTM D 4802-88: Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.

C. Federal Specifications:

1. FS GG-S-00172D(1): Screen, Projection.
2. Federal Standard 191A/5760: Mildew Resistance of Textile Materials.
3. Federal Standard 191A/5903: Flame Resistance of Cloth; Vertical

D. National Fire Protection Association:

1. NFPA 701-1989: Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS: Submit the following under provisions of Section 01300.

A. Product data: screen specified.

B. Shop drawings: showing layout and types of projection screens. Show the following:

1. Location of screen centerline.
2. Anchorage details.
3. Accessories.
4. Frame details for front projection screens.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through partition.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.

B. Protect screens from damage during delivery, handling, storage, and installation.

C. Store rear projection screens in manufacturer's protective packages in a position that complies with screen manufacturer's directions. Keep units in manufacturer's protective packages until time of installation.

D. Protect surfaces of rear projection screens from damage due to abrasion, dust, and other conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Da-Lite Screen Co., Inc. Product: Mark 30 (800) 622-3737.

B. Draper Shade & Screen Co., Inc. Product: Diamond Screen

(317) 987-7999.

C. Stewart Filmscreen Corp. Product: Opta Screen (800) 762-4999.

2.2 PROJECTION SCREEN SURFACES, GENERAL

A. Measurement of Gain of Screen Viewing Surface: Measure gain of screen viewing surface against that of a magnesium carbonate surface by means of a photogoniometer using test methods and test apparatus per FS GG-S-00172D(1) for determining effect of reflected light at various viewing angles on screen surfaces. Ratings of 1.0 refer to those viewing surfaces having a reflectivity equal to the magnesium carbonate surface.

B. Material and Viewing Surface of Front Projection Screens: Obtain screens manufactured from mildew- and flame-resistant fabric of type indicated for each type of screen specified and complying with the following requirements:

1. Matte white viewing surface with minimum gain characteristics complying with FS GG-S-00172D(1) for Type A screen surface.

   a. Application: Provide matte white surfaces unless otherwise indicated.

   b. Edge Treatment: Without black masking borders.

2. Mildew Resistance: Provide mildew-resistant screen fabrics as determined by Federal Standard 191A/5760.
3. Fire Performance Characteristics: Provide projection screen fabrics identical to those materials that have undergone testing and passed requirements for flame resistance as indicated below:

   a. NFPA 701 per small-scale test.
   b. Federal Standard 191A/5903 for test method. FS GG-S-00172D(1) for flame resistance.

2.3 ELECTRICALLY OPERATED FRONT PROJECTION SCREENS

A. General: Provide manufacturer's standard UL-listed and UL-marked units consisting of case, screen, motor, controls, conduit, and wire from control switch to motor, mounting accessories, and other components required for a complete installation and to comply with requirements indicated for screen surface and controls and for case, motor, and screen under description of operation and type. Remotely control operation of each screen to comply with the following:

1. Single Station Control: Three-position, UL-listed control switch for each screen with metal device box and cover plate for flush wall mounting and for connection to 120 V a.c. power supply.

B. End-Mounted-Motor-Operated Screens with Automatic Ceiling Closure: Units designed and fabricated for recessed installation in ceiling with bottom of case composed of two panels fully enclosing screen and motor, one panel hinged and connected to drive mechanism to open and close automatically when screen is lowered and fully raised and the other panel removable or openable for access to interior of case; and complying with the following requirements:

1. Screen Case: Wood sides and top with metal-lined motor compartment and wood or aluminum bottom panels, factory-primed and constructed as follows:

a. Offset mount bottom panels to case in position where their bottom surfaces will align flush with finished surface of adjoining ceiling and the bottom edges of case surrounding panels will be recessed by the depth of, and concealed behind, overlapping ceiling finish.

2. Screen: As indicated below, with top edge mounted on, and securely anchored to, rigid metal roller supported by self-aligning bearings in brackets.

a. Material: Vinyl-coated glass fiber fabric.
b. Size of Viewing Surface: As indicated.

C. Motor-In-Roller-Operated Screens with Automatic Ceiling Closure: Units designed and fabricated for recessed installation in ceiling with bottom of case composed of two panels fully enclosing screen and wiring compartments, one panel hinged and activated by operation of screen to open and close automatically when screen is lowered and fully raised and the other panel removable or openable for access to interior of case; and complying with the following requirements:

1. Screen Case: Metal sides and top for both screen and wiring compartment and metal bottom panel, factory-primed and constructed as follows:

a. Offset mount bottom panels to case in position where their bottom surfaces will align flush with finished surface of adjoining ceiling and the bottom edges of case surrounding panels will be recessed by the depth of, and concealed behind, overlapping ceiling finish.

2. Motor: Instant reversing motor of size and capacity recommended by screen manufacturer with permanently lubricated ball bearings, automatic thermal overload protection, preset limit switches to automatically stop screen in "up" and "down" positions, and positive stop action to prevent coasting. Mount motor inside roller with vibration insulators to reduce noise transmission.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.

B. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.

1. Test electrically operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition.

3.2 PROTECTION AND CLEANING

A. Protect projection screens after installation from damage during construction. If despite such protection damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

1. Provide temporary covering of rear projection screens until time of Substantial Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

END OF SECTION

SECTION 11134

PROJECTION SCREENS (MANUALLY OPERATED)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manually operated front projection screens.

1.2 Related Sections:

A. Section 06114 - Wood Blocking and Curbing.

B. Section 09111 - Metal Stud Framing System.

C. Section 09260 - Gypsum Board System.

1.3 REFERENCES

A. American Architectural Manufacturers Association

1. AAMA 606.1: Voluntary Guide specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
2. AAMA 607.1-1977: Voluntary Guide Specification and Inspection Methods for Integral Clear Anodic Finishes for Architectural Aluminum.
3. AAMA 608.1-1977: Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

B. American Society for Testing and Materials:

1. ASTM B 221-90: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
2. ASTM C 1036-90: specification for Flat Glass.
3. ASTM D 1003-61 (1988): Test Method for Haze and Luminous Transmittance of Transparent Plastics.
4. ASTM D 4802-88: Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.

C. Federal Specifications:

1. FS GG-S-00172D(1): Screen, Projection.
2. Federal Standard 191A/5760: Mildew Resistance of Textile Materials.
3. Federal Standard 191A/5903: Flame Resistance of Cloth; Vertical

D. National Fire Protection Association:

1. NFPA 701-1989: Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS: Submit the following under provisions of Section 01300.

A. Product data: screen specified.

B. Shop drawings: showing layout and types of projection screens. Show the following:

1. Location of screen centerline.
2. Anchorage details.
3. Accessories.
4. Frame details for front projection screens.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through partition.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.

B. Protect screens from damage during delivery, handling, storage, and installation.

C. Store projection screens in manufacturer's protective packages in a position that complies with screen manufacturer's directions. Keep units in manufacturer's protective packages until time of installation.

D. Protect surfaces of projection screens from damage due to abrasion, dust, and other conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Da-Lite Screen Co., Inc. Product: Model C (800) 622-3737.

B. Draper Shade & Screen Co., Inc. Product: Luma 2 Screen

(317) 987-7999.

C. Stewart Filmscreen Corp. Product: Luxus Communicator (800) 762-4999.

2.2 PROJECTION SCREEN SURFACES, GENERAL

A. Measurement of Gain of Screen Viewing Surface: Measure gain of screen viewing surface against that of a magnesium carbonate surface by means of a photogoniometer using test methods and test apparatus per FS GG-S-00172D(1) for determining effect of reflected light at various viewing angles on screen surfaces. Ratings of 1.0 refer to those viewing surfaces having a reflectivity equal to the magnesium carbonate surface.

B. Material and Viewing Surface of Front Projection Screens: Obtain screens manufactured from mildew- and flame-resistant fabric of type indicated for each type of screen specified and complying with the following requirements:

1. Matte white viewing surface with minimum gain characteristics complying with FS GG-S-00172D(1) for Type A screen surface.

   a. Application: Provide matte white surfaces unless otherwise indicated.

   b. Edge Treatment: Without black masking borders.

2. Mildew Resistance: Provide mildew-resistant screen fabrics as determined by Federal Standard 191A/5760.
3. Fire Performance Characteristics: Provide projection screen fabrics identical to those materials that have undergone testing and passed requirements for flame resistance as indicated below:

   a. NFPA 701 per small-scale test.
   b. Federal Standard 191A/5903 for test method. FS GG-S-00172D(1) for flame resistance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.

B. Install projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner

that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.

3.2 PROTECTION AND CLEANING

A. Protect projection screens after installation from damage during construction. If despite such protection damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 12512

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 08520 - Aluminum Window: Wall opening head support brackets.

1.3 RELATED SECTIONS

A. Section 06114 - Wood Blocking and Curbing: Wall opening head support blocking.

B. Section 08520 - Aluminum Window: Window framing and interior reveals.

1.4 SYSTEM DESCRIPTION

A. Horizontal slat louver blinds installed at window openings; manual control of raising and lowering by cord for full range locking; blade angle adjustable by control wand.

1.5 SUBMITTALS: Make submittals in accordance with Section 01300.

A. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

B. Product Data: Provide data indicating physical and dimensional characteristics,and operating features.

C. Samples: Submit two samples, 1 inch long illustrating slat materials and finish, color, rod type and color.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 COORDINATION

A. Coordinate the work with window installation and placement of concealed blocking to support blinds.

1.9 EXTRA MATERIALS

A. Provide ten additional slats.

B. Provide two additional complete blind assemblies of each size.

C. Provide two extra control rods.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hunter Douglas Inc., Two Park Way
Upper Saddle River, N.J.
Product: Contract Viscount 1" Aluminum Blinds

B. Levolar, 25 Grunpond Rd, Rockaway, N.J.
Product: Riveria 1" Contract Blind

C. Springs Window Fashions Division Inc.
Product: Bali Classics Custom 1" wide aluminum blinds

2.2 MATERIALS

A. Metal Slats: 1 inch wide; 0.011 inch thick spring tempered pre-finished aluminum horizontal slats, square slat corners, with manufacturing burrs removed.

B. Slat Support: Woven polypropylene, ladder configuration.

C. Head Rail: Pre-finished, formed steel box; internally fitted with hardware, pulleys, and bearings for operation.

D. Control Wand: Extruded hollow plastic; square shape; non-removable type; length of window opening height less plus 3 inches.

E. Head Support Bracket: Overhead head rail attachment; provide to Section 08520 for installation.

F. Accessory Hardware: Type recommended by blind manufacturer.

2.3 FINISHES

A. Blind Slat and Head Rail Housing: Color as selected by Architect.

B. Control Wand: Color as selected by Architect.

2.4 FABRICATION

A. Fabricate blinds to fit openings with uniform edge clearance of 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed.

3.2 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

C. Place intermediate head supports at spacing recommended by the blind manufacturer.

3.3 INSTALLATION TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/8 inch.

B. Maximum Offset From Level: 1/8 inch.

3.4 ADJUSTING

A. Adjust blinds for smooth operation.

3.5 CLEANING

A. Clean blind surfaces just prior to occupancy.

3.6 SCHEDULE

END OF SECTION

SECTION 12390

CABINETS AND COUNTERTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. BHMA A156.9 - Cabinet Hardware

B. KCMA A161.1 - Recommended Performance & Construction Standards for Kitchen and Vanity Cabinets

C. NEMA LD 3 - High-Pressure Decorative Laminates

1.2 DESIGN

A. Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Cabinets shall be constructed as specified and shall meet the requirements of KCMA A161.1. Wall and base cabinet assemblies shall consist of individual units joined into continuous sections. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim when indicated. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable as indicated.

1.3 SUBMITTALS: Submit under provisions in Section 01300.

A. Data: Manufacturer's printed data, catalog cuts, and installation instructions.

B. Drawings: Drawings showing each type of cabinet and related item, and clearly indicating the complete plan and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

C. Reports: Test reports shall certify that all cabinets comply with the requirements of KCMA A161.1. Tests shall be conducted by independent laboratories approved by KCMA. KCMA certification seals affixed to the cabinets will be accepted in lieu of certified test

reports.

D. Samples: In lieu of individual samples, complete minimum size cabinets may be furnished as samples. Mock-up units are not acceptable. Samples shall be of sufficient size to show color pattern and method of assembly.

a) Counter top and backsplash - One section, containing both.

b) Door and drawer front - One of each, with hardware mounted.

c) Melamine plastic color samples shall be approximately 2" x 3" size.

d) Stain/color samples shall be approximately 2" x 3" size.

END OF SECTION

SECTION 12690

RECESSED ENTRY MAT

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals."

A. SD-02, Manufacturer's Catalog Data

1. Recessed entry mat

B. SD-03, Manufacturer's Standard Color Charts

1. Recessed entry mat

C. SD-04, Drawings

1. Recessed entry mat details. Submit sufficient detail to verify installation method and compliance with requirements.

D. SD-19, Operation and Maintenance Manuals

1. Recessed entry mat

Submit cleaning instructions and stain removal procedures.

PART 2 PRODUCTS

2.1 FRAME

Aluminum recessed angle frame, 6063-T5 aluminum alloy. Zinc chromate primer applied to all surfaces in contact with concrete. Mill finish.

2.2 MAT

Aluminum hinge mat with nylon carpet insert.

Aluminum to be 6063-T52 alloy, mill finish, spaced 2" on center with drain holes between all rails. Carpet inserts shall be 100% nylon, fusion bonded to backing and mechanically secured in tread rails. Color to be dark gray.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that floor opening is ready to receive work. Verify that field measurements are as shown on drawings. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

Verify size of floor recess before fabricating mat. Vacuum clean floor recess.

3.3 INSTALLATION

Install mat in floor recess flush with finish floor after final cleaning of finish flooring.

3.4 TOLERANCES

Maximum gap allowed between frame and mat: 1/4 inch.

END OF SECTION

SECTION 13080

SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded, and Seamless
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 500	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(1994) Carbon and Alloy Steel Nuts
ASTM A 603	(1994) Zinc-Coated Steel Structural Wire Rope
ASTM A 653/A 653M	(1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM E 488	(1990) Strength of Anchors in Concrete and Masonry Elements
ASTM E 580	(1991) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1	(1981; Supple 199O; R 1992) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO-01	(1997) Uniform Building Code (3 Vol.)

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-12	(1991; Appx E, 1993) Seismic Restraint Manual Guidelines for Mechanical Systems

UNDERWRITERS LABORATORIES (UL)

UL 1570	(1995) Fluorescent Lighting Fixtures
UL 1571	(1991; Rev thru Mar 95) Incandescent Lighting Fixtures

1.2 SYSTEM DESCRIPTION

1.2.1 General

The requirements for seismic protection measures described in this section shall be applied to mechanical/electrical equipment and systems specified herein. Seismic protection requirements shall be in accordance with ICBO-01 using an importance factor of 1.0 and shall be provided in addition to any other requirements called for in other sections of these specifications. This facility shall be designed as being in seismic zone 2A; no other zone values shall be used to establish bracing requirements. Lateral support against earthquake induced forces shall be accomplished by positive attachments without consideration of friction resulting from gravity loads. The Contractor shall note the distance between mounting height and the roof structure.

1.2.2 Mechanical/Electrical Equipment

Mechanical/electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Boilers and furnaces
Water Heaters
Expansion Air Separator Tanks
Heat Exchangers
Water Chiller Units
Air Compressors
Control Panels
Pumps with Motors
Light Fixtures
Motor Control Centers
Switchboards (Floor Mounted)
Suspended Ceiling Assemblies
Unit Heaters
Exhaust and Return Fans
Storage Tanks for Water
Water and Gas Piping
Cable Trays
Air Handling Units
Switchgear
Unit Substations
Transformers
Ducts

1.2.3 Mechanical/Electrical Systems

The following mechanical and electrical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification:

All Piping Inside the Building in Accordance With This Specification
Chilled Water Distribution Systems Outside of Buildings
All Water Supply Systems
Storm and Sanitary Sewer Systems
All Process Piping
Pneumatic Tube Distribution System

1.2.4 Equipment and Systems

The bracing for the following mechanical/electrical equipment and systems shall be developed by the Contractor in accordance with the requirements of this specification.

1.2.5 Exclusion

Seismic protection of piping for fire protection systems shall be installed as specified in Sections 13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, 13935 DRY PIPE SPRINKLER SYSTEM, FIRE PROTECTION, and 13945 PREACTION AND DELUGE SPRINKLER SYSTEMS, FIRE PROTECTION.

1.2.6 Pipes and Ducts Requiring No Special Seismic Restraints

Seismic restraints may be omitted from the following installations:

a. Gas piping less than 1 inch inside diameter.

b. Piping in boiler and mechanical equipment rooms less than 1-1/4 inches inside diameter.

c. All other piping less than 1-1/2 inches inside diameter.

d. Electrical conduit less than 2-1/2 inches inside diameter.

e. Rectangular air handling ducts less than 4 square feet in cross sectional area.

f. Round air handling ducts less than 18 inches in diameter.

g. Piping suspended by individual hangers 12 inches or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.

h. Ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below.

In exemptions g. and h. all hangers shall meet the length requirements. If the length requirement is exceeded by one hanger in the run, the entire run shall be braced.

1.2.7 All Other Interior Piping, Conduit, and Ducts

Interior piping, conduit, and ducts not covered by paragraphs Exclusion or Pipes and Ducts Requiring No special Seismic Restraints shall be seismically protected in accordance with the provisions herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Bracing and Coupling; GA. Lighting Fixtures in Buildings; GA. Miscellaneous Equipment; GA.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-04 Drawings

Bracing and Coupling; GA. Flexible Couplings or Joints; GA. Resilient Vibration Isolation Devices; GA. Lighting Fixtures in Buildings; GA. Miscellaneous Equipment; GA.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-13 Certificates

Flexible Ball Joints; GA.

Flexible ball joints shall be certified to be suitable for the service intended by the manufacturer, based on not less than 2 years' satisfactory operation in a similar application.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the requirements specified below:

2.1.1 Bolts and Nuts

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153.

2.1.2 Sway Bracing

Material used for members listed in this section, shall be structural steel conforming with the following:

a. Plates, rods, and rolled shapes, ASTM A 36/A 36M.

b. Wire rope, ASTM A 603.

c. Tubes, ASTM A 500, Grade B.

d. Pipes, ASTM A 53, Type E, Grade B.

e. Light gauge angles, less than 1/4 inch thickness, ASTM A 653/A 653M.

2.1.3 Flexible Couplings

Flexible couplings shall have same pressure and temperature ratings as adjoining pipe.

2.1.3.1 Flexible Ball Joints

Flexible ball joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation plus not less than 15-degree angular movement.

2.1.3.2 Flexible Mechanical Joints

a. Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

b. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be high-strength type as specified above.

2.1.4 Lighting Fixture Supports

Fixture supports shall be malleable iron. Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable.

PART 3 EXECUTION

3.1 BRACING AND COUPLING

Bracing and coupling shall conform to the arrangements shown. Provisions of this paragraph apply to all piping within a 5 foot line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same intervals as determined by the smallest diameter pipe of the group. No trapeze-type hanger shall be secured with less than two 1/2 inch bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

3.2 BUILDING DRIFT

Sway braces for a run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided. Joints capable of accommodating seismic displacements shall be provided where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, swing joints shall be provided. For piping with manufactured ball joints the seismic drift shall be 0.015 feet per foot of height above the base where the seismic separation occurs; this drift value shall be used in place of the expansion given in the manufacturer's selection table.

3.3 FLEXIBLE COUPLINGS OR JOINTS

3.3.1 Building Piping

Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 3-1/2 inches in diameter. Flexible couplings or joints shall be braced laterally without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these requirements.

3.4 PIPE SLEEVES

Pipe sleeves in interior non-fire rated walls shall be sized as indicated on the drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve.

3.5 SPREADERS

Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers

are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields in accordance with the requirements of Section 15080THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.6 ANCHOR BOLTS

3.6.1 Cast-In-Place

Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. Two nuts shall be provided on each bolt. Anchor bolts shall conform to the following tabulation for the various equipment weights and specified seismic zone or the manufacturer's installation recommendations, whichever is the most stringent, unless otherwise shown on the drawings. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.6.2 Minimum Bolt Sizes, Cast-In-Place Anchor Bolts

Maximum Equipment	Minimum Bolt Sizes (Inches)*				
Weight (LBs)	Zone 4	Zone 3	Zone 2A	Zone 2B	Zone 1
500	1/2	1/2	1/2	1/2	1/2
1,000	1/2	1/2	1/2	1/2	1/2
5,000	1/2	1/2	1/2	1/2	1/2
10,000	1/2	1/2	1/2	1/2	1/2
20,000	1/2	1/2	1/2	1/2	1/2
30,000	5/8	1/2	1/2	1/2	1/2

*Based on four bolts per item, a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Equivalent total cross-sectional area shall be used when more than four bolts per item are provided. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt.

3.6.3 Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. The expansion anchor size shall be not less than that required in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

3.6.3.1 General Testing

Expansion and chemically bonded anchors shall be tested in place after installation. The tests shall occur not more than 24 hours after installation of the anchor and shall be conducted by an independent testing agency; testing shall be performed on random anchor bolts as described below.

3.6.3.2 Torque Wrench Testing

Torque wrench testing shall be done on not less than 50 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque shall equal

the minimum required installation torque as required by the bolt manufacturer. Torque wrenches shall be calibrated at the beginning of each day the torque tests are performed. Torque wrenches shall be recalibrated for each bolt diameter whenever tests are run on bolts of various diameters. The applied torque shall be between 20 and 100 percent of wrench capacity. The test torque shall be reached within one half turn of the nut, except for 3/8 inch sleeve anchors which shall reach their torque by one quarter turn of the nut. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified torque; if the anchor still fails the test it shall be replaced.

3.6.3.3 Pullout Testing

Expansion and chemically bonded anchors shall be tested by applying a pullout load using a hydraulic ram attached to the anchor bolt. At least 5 percent of the anchors, but not less than three per day shall be tested. The load shall be applied to the anchor without removing the nut; when that is not possible, the nut shall be removed and a threaded coupler shall be installed of the same tightness as the original nut. The test setup shall be checked to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus shall be at least 1.5 times the embedment length away from the bolt being tested. Each tested anchor shall be loaded to the design tension value for the anchor. The anchor shall have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified load; if the anchor still fails the test it shall be replaced.

3.7 RESILIENT VIBRATION ISOLATION DEVICES

Selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS except that an equipment weight equal to five times the actual equipment weight shall be used.

3.7.1 Resilient and Spring-Type Vibration Devices

Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 0.5 inches.

3.7.2 Multidirectional Seismic Snubbers

Multidirectional seismic snubbers employing elastomeric pads shall be installed on all floor- or slab-mounted equipment. These snubbers shall provide 0.25 inches free vertical and horizontal movement from the static deflection point. Snubber medium shall consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

3.8 SWAY BRACES FOR PIPING

Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

3.8.1 Transverse Sway Bracing

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those given in the tabulation below as modified for each seismic zone. All runs shall have a minimum of two transverse braces.

Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

3.8.2 Maximum Span for Transverse Sway Braces in Seismic Zone 4

Pipe Diameter	Std. Wgt. Steel Pipe - 40S		Ex. Strong Steel Pipe - 80S		Copper Tube Type L	
(in.)	*L(ft.)	**F(lbs.)	*L(ft.)	**F(lbs.)	*L(ft.)	**F(lbs.)
1	22	70	22	80	11	17
1-1/2	25	140	26	180	12	35
2	29	220	30	290	14	70
2-1/2	32	380	33	460	15	110
3	34	550	35	710	17	150
3-1/2	36	730	38	930	18	220
4	39	960	40	1,200	19	300
5	41	1,440	44	1,900	20	470
6	45	2,120	46	2,750	22	730
8	49	3,740	54	5,150	26	1,550
10	54	6,080	59	7,670	28	2,630
12	58	8,560	61	10,350	31	3,950

*L = Maximum span between lateral supports multiplied by 1.1 for Zone 3, 1.25 for Zone 2A, 1.2 for Zone 2B, or 1.35 for Zone 1.

**F = Horizontal force on the brace multiplied by 0.8 for Zone 3, 0.5 for Zone 2A, 0.6 for Zone 2B, or 0.3 for Zone 1.

NOTE: Bracing shall consist of at least one vertical angle 2 x 2 x 16 gauge and one diagonal angle of the same size.

3.8.3 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided at 40 foot intervals except when the location of sway braces is shown on the drawings for the particular piping system. All runs shall have one longitudinal brace minimum. Sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.8.4 Vertical Runs

Vertical runs of piping shall be braced at not more than 10 foot vertical intervals. For tubing, bracing shall be provided at no more than 4 foot spacing. Vertical braces shall be above the center of gravity of the span being braced. All sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.8.5 Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.8.6 Maximum Length for Anchor Braces

Type	Size (Inches)	Maximum Length* (Feet/Inches)	Allowable Loads* (kips)
Angles	1-1/2 x 1-1/2 x 1/4	4-10	5.7

Type	Size (Inches)	Maximum Length* (Feet/Inches)	Allowable Loads* (kips)
	2 x 2 x 1/4	6-6	7.8
	2-1/2 x 1-1/2 x 1/4	8-0	9.8
	3 x 2-1/2 x 1/4	8-10	10.8
	3 x 3 x 1/4	9-10	11.9
Rods	3/4	3-1	3.7
	7/8	3-8	5.0
Flat Bars	1-1/2 x 1/4	1-2	3.1
	2 x 1/4	1-2	4.1
	2 x 3/8	1-9	6.2
Pipes (40S)	1	7-0	4.1
	1-1/4	9-0	5.5
	1-1/2	10-4	6.6
	2	13-1	8.9

*Based on the slenderness ratio of l/r = 200 and ASTM A 36/A 36M steel, where l is the length of the brace and r is the least radius of gyration of the brace.

3.8.7 Clamps and Hangers

Clamps or hangers on uninsulated pipes shall be applied directly to pipe. Insulated piping shall have clamps or hangers applied over insulation in accordance with Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.8.8 Bolts

Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2 inch diameter.

3.9 SWAY BRACES FOR DUCTS

3.9.1 Braced Ducts

Bracing details and spacing for rectangular and round ducts shall be in accordance with SMACNA-12, including Appendix E, using Seismic Hazard Level C.

3.9.2 Unbraced Ducts

Hangers for unbraced ducts shall be positively attached to the duct within 2 inches of the top of the duct with a minimum of two #10 sheet metal screws. Unbraced ducts shall be installed with a 6 inch minimum clearance to vertical ceiling hanger wires.

3.10 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe.

3.11 EQUIPMENT SWAY BRACING

3.11.1 Suspended Equipment

Equipment sway bracing shall be provided for items supported from overhead floor or roof structures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 1/2 inch bolts. Braces shall conform to paragraph Maximum Length for Anchor Braces. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 0.56 times the weight of equipment without

exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for approval. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.11.2 Floor or Pad Mounted Equipment

3.11.2.1 Shear Resistance

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

3.11.2.2 Overturning Resistance

The ratio of the height of the equipment (measured from the base to the center of gravity of the equipment) to the minimum distance between anchor bolts shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. If this ratio is greater than 4.44 the bolt values in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts shall not be used and calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

3.12 MISCELLANEOUS EQUIPMENT

3.12.1 Rigidly Mounted Equipment

The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand a horizontal lateral force of 0.11 times the operating weight of the equipment, at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage, which would render the equipment inoperative for significant periods of time following an earthquake.

Rigidly Mounted Equipment

Boilers
Chillers
Air-Handling Units
Cooling Towers
Engine-Generators
Substations
Transformers
Switch Boards and Switch Gears
Motor Control Centers
Free Standing Electric Motors
Surge Tanks
Elevator Hydraulic Power Unit

3.12.2 Nonrigid or Flexibly-Mounted Equipment

The following specific items of equipment to be furnished shall be constructed and assembled to resist a horizontal lateral force of 0.56 times the operating weight of the equipment at the vertical center of gravity of the equipment.

3.13 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

3.13.1 Pendant Fixtures

Loop and hook or swivel hanger assemblies for pendant fixtures shall be fitted with a restraining device to hold the stem in the support position during earthquake motions. Pendant-supported fluorescent fixtures shall also be provided with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bends in conductors or damage to insulation.

3.13.2 Recessed Fluorescent Fixtures

Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system and shall be fastened thereto at each corner of the fixture with bolts or approved clips; or shall be provided with fixture support wires attached to the building structural members using two wires for individual fixtures, attached to opposite corners, and one wire per unit of continuous row mounted fixtures. Each wire support shall be capable of supporting four times the weight of the fixture. Recessed lighting fixtures not over 56 pounds in weight and suspended or pendant-hung fixtures not over 20 pounds in weight may be supported by and attached directly to the ceiling system runners by a positive attachment such as screws or bolts, number and size as required by design seismic zone. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

3.13.3 Assembly Mounted on Outlet Box

A supporting assembly that is intended to be mounted on an outlet box shall be designed to accommodate mounting features on 4 inch boxes, 3 inch plaster rings, and fixture studs.

3.13.4 Surface-Mounted Fluorescent Fixtures

Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system. Fixture support devices for attaching to suspended ceilings shall be a locking-type scissor clamp or a full loop band that will securely attach to the ceiling support. Fixtures attached to underside of a structural slab shall be properly anchored to the slab at each corner of the fixture.

3.13.5 Wall-Mounted Emergency Light Unit

Each wall-mounted emergency light unit shall be secured to remain in place during a seismic disturbance.

3.13.6 Lateral Force

Light fixture bracing shall be designed to resist a lateral force of 0.56 times the fixture weight.

3.14 SUSPENDED CEILING ASSEMBLIES

The structural members of ceiling support systems, used primarily to support acoustical tile panels or acoustical panel lay-in tiles, with or without lighting fixtures, ceiling-mounted air terminals, and ceiling-mounted services, shall conform to the following:

3.14.1 Design Loads

The main runners and cross-runners and their splices and intersection connections shall be designed for two times the design load or ultimate axial tension or compression (minimum 120 pounds.) The connections at the splices and intersections shall be of a mechanical interlocking type that cannot easily be disengaged. Ceiling structural systems shall be designed

to withstand required vertical load as well as a lateral force of 11.3 percent of the ceiling weight. The ceiling weight shall include all lighting fixtures and other equipment that are laterally supported by the ceiling and shall be not less than 4.0 psf. Exception: Ceiling areas of 144 square feet or less surrounded by walls that connect directly to the structure above will be exempt from the lateral-load standards of this specification.

3.14.2 Installation Requirements

Installation requirements shall be in accordance with ASTM E 580 except as follows:

3.14.2.1 Vertical Support

Hanger wires supporting a maximum tributary ceiling area of 16 square feet shall be a minimum of 10 gauge in diameter. The size of wires supporting a tributary ceiling area greater than 16 square feet shall be substantiated by design calculations. Hanger attachment devices used in ceiling systems not exceeding 4 psf shall be capable of supporting a minimum allowable load of 300 pounds. Hanger attachment devices used in ceiling systems exceeding 4 psf shall be capable of supporting the design load and shall be substantiated by design calculations. If hangers must be splayed more than one horizontal to six vertical, the resulting horizontal force shall be offset by bracing or counter-splaying, and substantiated by design calculations.

3.14.2.2 Lateral Support

In lieu of the design criteria stated above, where ceiling loads do not exceed 4 psf, lateral support for the ceiling system may be provided by four galvanized wires of minimum No. 12 gauge, as indicated in ASTM E 580, paragraph 4.4.6.

3.14.3 Lighting Fixture and Air Diffuser Supports

Lighting fixture and air diffuser supports shall be designed and installed to meet the requirements of equipment supports in the preceding paragraphs of this specification with the following exceptions:

a. Recessed lighting fixtures not over 56 pounds in weight and suspended and pendent-hung fixtures not over 20 pounds in weight may be supported and attached directly to the ceiling system runners by a positive attachment such as screws or bolts.

b. Air diffusers that weigh not more than 20 pounds and that receive no tributary loading from ductwork may be positively attached to and supported by the ceiling runners.

-- End of Section --

SECTION 14245

HYDRAULIC ELEVATORS - PASSENGER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydraulic elevator system; hydraulic cylinder in buried casing.

B. Passenger cab with doors and frames; hoistway entrance doors and frames.

C. Motor and pump, controllers, hoistway, equipment, and accessories.

D. Batteries furnished and installed for the following:

1. Provide 90 minutes of cab lighting.
2. Automatic switchover to batteries to lower cab to ground floor when power outage occurs.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Concrete for elevator motor and pump foundation, and pit, grouting thresholds, and temporary machine room floor slab.

B. Section 04311 - Concrete Unit Masonry: Building-in and grouting hoistway door frames; masonry hoistway enclosure.

C. Section 05120 - Structural Steel: Hoistway framing, divider beams, and overhead hoist beams.

D. Section 05500 - Metal Fabrications: Pit ladder, Sill supports.

E. Section 07120 - Fluid Applied Waterproofing: Waterproofing of elevator pit walls and floor.

F. Section 09650 - Resilient Flooring: Floor finish in cab.

G. Section 10522 - Fire Extinguishers, Cabinet, and Accessories: Fire extinguisher in elevator machine room.

H. Section 16111 - Conduit: Empty conduit to elevator equipment devices remote from elevator machine room or hoistway.

I. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

J. Section 16180 - Equipment Wiring Systems: Electrical service to main disconnect in elevator machine room including electrical power for elevator installation and testing.

K. Section 16180 - Equipment Wiring Systems: Electrical service for machine room, pit.

L. Section 16180 - Equipment Wiring Systems: Lighting in elevator pit.

M. Section 16180 - Equipment Wiring Systems: Empty conduit for telephone service elevator.

N. Section 16721 - Fire Alarm and Smoke Detection Systems: Fire and smoke detectors and interconnecting devices.

O. Section 16721 - Fire Alarm and Smoke Detection Systems: Fire alarm signal lines to elevator controller cabinet.

1.3 REFERENCES

A. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.

C. ANSI/ASME A17.1 - Safety Code for Elevators and Escalators.

D. ANSI/ASME A17.2 - Inspector's Manual For Elevators and Escalators.

E. ASTM A36 - Structural Steel.

F. ASTM A366 - Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

G. ANSI/AWS D1.1 - Structural Welding Code, Steel.

H. ANSI/NFPA 70 - National Electrical Code.

I. ANSI/NFPA 80 - Fire Doors and Windows.

J. ANSI/UL 10B - Fire Tests of Door Assemblies.

K. APA - American Plywood Association.

L. ASTM A139 - Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4-in. and Over).

M. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

N. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

O. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

P. NEMA LD3 - High Pressure Decorative Laminates.

Q. NEMA MG1 - Motors and Generators

R. Steel Structures Painting Council (SSPC) - Steel Structures Painting Manual.

1.4 SYSTEM DESCRIPTION

A. Hydraulic Elevator System: One unit;telescoping holeless; with motor and pump adjacent approximately 2 feet distant from the hoistway.

B. Characteristics of elevator #1.

1. Rated Net Capacity: 2100 lbs.
2. Rated Speed: 125 ft/min.
3. Nominal Platform Size: 72" x 55" inches (1829 x 1397 mm).
4. Clear Net Platform Size: 68" x 51" inches.
5. Cab Height: 96 inch.
6. Hoistway and Cab Entrance Frame Opening Sizes: 36 x 84 inches (914 x 2134 mm).
7. Door Type: Single slide, left hand.
8. Door Operation: Side opening.
9. No. of Stops: one.
10. No. of Openings: One front, one rear.

C. Door Control Features:

1. Program door control to open doors automatically when car arrives at floor.
2. Render "Door Close" button inoperative when car is standing at dispatching terminal with doors open.
3. If doors are prevented from closing for approximately ten seconds because of an obstruction, automatically disconnect door reopening devices, close doors more slowly until obstruction is cleared. Sound buzzer.
4. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equip with object proximity detector device.

D. Interconnect elevator control system with building fire alarm, smoke alarm, system.

E. Temporary Elevator Use: Enclose elevator early for transport of construction personnel.

1. Enclose cab with protective plywood on floor, walls, and ceiling.
2. Provide temporary lighting.

3. Provide control panel with manual and emergency operation with key operation for attendant operator.

F. Seismic Design: In accordance with applicable local code.

1.5 TWO-STOP AUTOMATIC OPERATION

A. Set system operation so that upon momentary pressure of a hall button from another landing, dispatch car to that landing.

B. Allow call registered by momentary pressure of hall button at any time, to remain registered until car stops in response to that call at that landing.

C. If hoistway door car gate is not opened within a short interval after car has stopped at terminal, allow car to respond to any call from the other landing.

1.6 FIREFIGHTER'S SERVICE

A. Provide "Firefighter's Operation" in accordance with ANSI/ASME A17.1.

B. Designated Landing: Ground Floor.

1.7 INDEPENDENT SERVICE

A. Provide key operated "Independent Service" on car operating panel. Key activation will remove that car from normal operation and cancel all pre-registered car calls.

B. Car will respond to selected floor. Car will not respond to any calls from hall call buttons. Car will only respond to calls placed on the car operating panel. Doors will remain open at last landing requested. Doors will close with a constant pressure on "DOOR CLOSE" button.

C. Key activation to normal operation will return car to normal operation.

1.8 SUBMITTALS: Submit under provisions of Section 01300.

A. Shop Drawings: Indicate the following information:

1. Motor and hydraulic pump, valves, controller, selector, governor and other component locations.
2. Car, machine beams, guide rails, buffers, and other components in hoistway.
3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
4. Individual weight of principal components; load reaction at points of support.
5. Loads on hoisting beams.
6. Clearances and over travel of car.
7. Location of components in machine room.
8. Locations in hoistway and machine room of connections for car light and telephone.
9. Location and sizes of access doors, doors, and frames.
10. Expected heat dissipation of elevator equipment in machine room.
11. Applicable seismic design data; certified by a Registered Professional Structural Engineer.
12. Electrical characteristics and connection requirements.
13. Show arrangement of equipment in machine room so moving elements and other equipment can be removed for repairs or replaced without disturbing other components. Arrange equipment for clear passage through access door.

B. Product Data: Provide data on the following items:

1. Signal and operating fixtures, operating panels, indicators.
2. Cab design, dimensions, layout, and components.
3. Cab and hoistway door and frame details.
4. Electrical characteristics and connection requirements.

C. Samples: Submit two samples, 6 x 6 inch (150 x 150 mm) in size illustrating cab floor material, cab interior finishes, cab and hoistway door and frame finishes.

1.9 OPERATION AND MAINTENANCE DATA

A. Include a parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.

B. Provide technical information for servicing operating equipment.

C. Include legible schematic of hydraulic piping and wiring diagrams of installed electrical equipment, and changes made in the Work. List symbols corresponding to identity or markings on machine room and hoistway apparatus.

D. Provide one copy of master electric and hydraulic schematic and one copy of lubrication chart, each framed with clear plastic; mount on machine room wall.

1.10 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI/ASME A17.1, ANSI/AWS D1.1, NFPA 70, AISC, and as supplemented in this section.

B. Fabricate and install door and frame assemblies in accordance with ANSI/NFPA 80 and ANSI/UL 10B.

1.11 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

B. Installer: Employees and supervisor on payroll of elevator equipment manufacturer.

1.12 REGULATORY REQUIREMENTS

A. Conform to applicable local code for manufacture and installation of elevator system.

B. Conform to ANSI A117.1 for provisions for the physically handicapped.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.13 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this section

B. Require attendance of persons directly involved with the work of this section.

C. Review schedule of installation, installation procedures and conditions, and coordination with related work.

D. Review temporary use of elevator, hours of use, scheduling of its use, cleanliness of cab, employment of operator, maintenance of system.

1.14 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.15 WARRANTY

A. Provide one year manufacturer's warranty.

B. Warranty: Include coverage for elevator operating equipment and devices.

1.16 MAINTENANCE SERVICE

A. Furnish service and maintenance of elevator system and components for one year from date of Substantial Completion during warranty period.

B. Examine system components monthly. Clean, adjust, and lubricate equipment.

C. Include systematic examination, adjustment, and lubrication of elevator equipment; maintain hydraulic fluid levels. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original equipment. Replace wire ropes when necessary to maintain the required factor of safety.

D. Perform work without removing cars during peak traffic periods.

E. Provide emergency call back service at all hours for this maintenance period.

F. Maintain locally, near the Place of the Work, an adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure the fulfillment of this maintenance service, without unreasonable loss of time.

G. Perform maintenance work using competent and qualified personnel, under the supervision and in the direct employ of the elevator manufacturer or original installer.

H. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Government.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Dover Elevator Company: Model Fleetwood 2100.

B. Otis Elevator Company: Model LRV2000.

C. Schindler Elevator Corp.: Model Fastrack 20H.

2.2 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: ANSI/ASTM A36.

B. Casing: ASTM A139, Grade A steel.

C. Sheet Steel: ANSI/ASTM A366 Class 1, with matte finish. ASTM A446 Grade B, zinc coated to G90.

D. Stainless Steel: ASTM A167 Type 304, No. 4 finish.

E. Aluminum: ASTM B221, extruded.

F. Plywood: APA Structural I, Grade C-D, sanded.

G. Plastic Laminate: NEMA LD3, GP-50 type, 3/4 inch (19 mm) thick; solid (one surface color). Equal to Formica Cherry Woodblock #7293-43.

H. Car enclosure materials to meet the requirements of ASME A17.1, Safety Code for Elevators and Escalators.

2.3 FINISH MATERIALS

A. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

B. Primer for Wood Surfaces: Alkyd primer sealer.

C. Finish Paint (for Metal Surfaces): Alkyd enamel, semi-gloss color as selected.

D. Finish Paint (for Wood Surfaces):

Alkyd enamel, semi-gloss color as selected.

2.4 EQUIPMENT

A. Motor, Pumps, Valves, Regulators, Fluid Tank, Hydraulic Fluid, Controller, Controls, Buttons, Wiring and Devices, Indicators: Required by ANSI/NFPA 70.

B. Guide Rails, Cables, Spring Buffers, Attachment Brackets and Anchors: Purpose designed, sized according to code with safety factors.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:

1. 15 hp rated load.
2. 460 volts, three phase, 60 Hz.
3. 40 amperes maximum dual element time delay, fuse size,

45 amperes thermal circuit breaker size. 31 fulll load amperes.

4. 90 percent minimum power factor at rated load.
5. Starter Characteristics: Solid state/Wye delta.
6. Refer to Section 16481.

B. Motor: [Refer to Section 15170.]

C. Disconnect Switch: Factory mount disconnect switch in control panel.

2.6 ELECTRICAL COMPONENTS

A. Boxes, Conduit, Wiring, and Devices: Required by ANSI/NFPA 70.

B. Fittings: Steel compression type for electrical metallic tubing. Fittings with set screws are acceptable only when a separate grounding conductor is also installed across the joint.

C. Spare Conductors: Include 10 percent extra conductors and two pairs of shielded audio cables in traveling cables. Do not parallel conductors to increase electric current capacity unless individually fused.

D. Do not use armored flexible metal conduit as a grounding conductor.

E. Include wiring and connections to elevator devices remote from hoistway and between elevator machine rooms. Provide additional components and wiring to suit machine room layout.

2.7 LUBRICATION

A. Grease Fittings: For lubricating bearings requiring periodic lubrication.

B. Grease Cups: Automatic feed type.

C. Lubrication Points: Visible and easily accessible.

2.8 CAR FABRICATION

A. Frame: Rigid and braced, rolled or formed steel sections, mounted on resilient isolators.

B. Platform: Steel frame, with fireproofed plywood subflooring assembly, ready to receive floor finish.

2.9 CAB FABRICATION

A. Flooring: Resilient tile flooring, of type specified in Section 09650.

B. Walls: Plastic laminate on plywood.

C. Front Return Panel: Baked enamel on steel.

D. Base: Resilient rubber cove, of type specified in Section 09650.

E. Ceiling: Plastic eggcrate diffuser. Accommodate a raised ceiling above finished ceiling to 96 inches (2439 mm) high, to the rear of the overhead cross beam.]

F. Light Fixtures: Fluorescent light troughs.

G. Ventilation: Single speed fan, grille above ceiling; perforations in base.

H. Control Panel and Face Plate: Stainless steel with illuminating call buttons.

I. Indicator Panel: Above door with illuminating position indicators.

J. Hand Rail: Stainless steel flat bar stock, spaced from wall 1.5 inches; placed at rear wall and side walls.

K. Pad Hooks: Stainless steel type, mounted at 72 inches high, in the cab.

L. Protective Pads: One set, canvas cover, padded with fill material, sewn with piping edges; brass grommets spaced to match pad hook spacing in cab, covering side and rear walls and front return, except cut-out for control panel.

M. Certificate Frame and Glazing: Stainless steel frame, clear tempered glass attached with tamper proof screws.

2.10 CAB ENTRANCES

A. Cab Doors: Baked enamel on steel; 16 gage thick metal, of hollow insulated sandwich panel construction, flush design, rolled profiles, rigid construction. Fabricate front return panels same as doors.

B. Cab Door Frames: Baked enamel on steel; 16 gage thick metal, welded corner design with smooth invisible joints.

C. Thresholds: Extruded aluminum type, to align with frame

return to allow reversing of cab carpet floor finish.

2.11 HOISTWAY ENTRANCES

A. Hoistway Doors (Main Floor): Baked enamel on steel; 16 gage thick metal, of hollow insulated sandwich panel construction, flush design, rolled profiles, rigid construction.

B. Hoistway Door Frames (Main Floor): Baked enamel on steel; 16 gage thick metal, of rolled profiles, welded corner with smooth invisible joints.

C. Hoistway Doors (Other Floors): Baked enamel on steel; 16 gage thick metal, of hollow insulated sandwich panel construction, flush design, rolled profiles, rigid construction.

D. Hoistway Door Frames (Other Floors): Baked enamel on steel; 16 gage thick metal, of rolled profiles, welded corner with smooth invisible joints.

E. Door and Frame Construction: UL 1-1/2 hour fire rating; insulated sandwich panel door construction 1-1/4 inch thick, minimum.

F. Weatherstrip hoistway doors and frames to minimize audible noise caused by air movement, imposed by car movement in the hoistway, and air pressure differential between hoistway and landing floors.

G. Sills: Extruded aluminum.

2.12 FINISHES

A. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

B. Machine Room Components: Clean and degrease; prime one coat, finish with one coat of enamel.

C. Galvanized Surfaces: Clean with neutralizing solvent; prime one coat.

D. Aluminum: Clear anodized

E. Wood Surfaces not Exposed to Public View: One coat primer; one coat enamel.

F. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two coats of

enamel sprayed and baked; color as selected.

G. Stainless Steel: No. 4 brushed.

2.13 MACHINE ROOM INTERFACING MONITOR

A. Fabricate one multiple terminal block in controller relay panel or selector, in location indicated, for connection of monitoring devices for:

1. Hall and car registration circuits.
2. Load weighing circuits.
3. Up and down peak programming circuits.
4. Independent service switches.

B. Label terminals for use with alligator test clips.

2.14 CAR OPERATING PANEL

A. Provide one flush mounted operating panel per car with applied face plate with an integral and front return face plate]; with front return panels containing illuminated call buttons corresponding to floors served, in car alarm button, and DOOR OPEN DOOR CLOSE buttons.

B. Position alarm button where it is unlikely to be accidentally actuated; not more than 54 inches above cab floor.

C. Include service cabinet, with hinged door and lock in each car.

D. Locate a 110 V, 15 A convenience receptacle in service cabinet.

E. Car Position Indicators:

F. Emergency Light:

G. Telephone Cabinet:

2.15 LANDING CONTROLS

A. Landing Buttons: Illuminating type, one for originating UP and one for originating DOWN calls, one button only at terminating landings; marked with arrows including indications required by ANSI A117.1.

B. Landing Position Indicators: Illuminating white.

C. Car Direction Indicators: Illuminating white.

2.16 PROVISION FOR HANDICAPPED

A. Comply with ANSI A117.1.

B. Provide indicators near controls in conformance with ANSI A117.1.

C. Landing Buttons: Illuminating type, one for originating UP and one for originating DOWN calls, one button only at terminating landings; marked with arrows including indications required by ANSI A117.1.

D. Locate highest button in elevator cab control panel and the center of the telephone handset, not more than 54 inches above floor level.

E. Hand Rails: Rectangular profile of 1.5 inch wide x 1/4 inch thick, solid stainless steel; position on one three sides of cab with ends returned.

F. Sound audible tone signal in car when car is stopping at a floor or passing a floor.

G. Include with illuminated landing indicators, audible tone signals; once for UP stops and twice for DOWN stops.

H. In each cab provide Arabic numerals 5/8 inch in height raised 0.03 inch Braille numerals immediately to left of floor buttons to identify each floor.

I. At each floor landing provide 2 inch floor numerals raised 0.03 inch on door frame jamb.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that hoistway, pit, and machine room are ready for work of this section.

B. Verify hoistway shaft and openings are of correct size and within tolerance.

C. Verify location and size of machine foundation and position of machine foundation bolts.

D. Verify that electrical power is available and of the correct characteristics.

3.2 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components.

3.3 EXCAVATION AND BACKFILLING FOR CASING

A. Excavating: Refer to Section 02221.

B. Maintain shaft alignment of 1 inch from plumb. Fill over excavated shaft depth with lean concrete.

C. Maintain shaft excavation free of water.

D. Backfilling: Refer to Section 02221.

3.4 INSTALLATION

A. Install in accordance with ANSI/ASME A17.1.

B. Install system components. Connect equipment to building utilities. Install piping between hoistway plunger and pump unit.

C. Provide conduit, boxes, wiring, and accessories.

D. Mount motor and pump unit on vibration and acoustic isolators, on bed plate and concrete pad. Place unit on structural supports and bearing plates. Securely fasten to building supports. Prevent lateral displacement.

E. Accommodate equipment in space indicated.

F. Install guide rails using threaded bolts with metal shims and lock washers under nuts. Compensate for expansion and contraction movement of guide rails.

G. Accurately machine and align guide rails. Form smooth joints with machined splice plates.

H. Bolt or weld brackets directly to structural steel hoistway framing.

I. Field Welds: Chip and clean away oxidation and residue, wire brush; spot prime with two coats.

J. Coordinate installation of hoistway wall construction.

K. Install hoistway door sills, frames, and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.

L. Fill hoistway door frames solid with grout in accordance with Section

M. Adjust equipment for smooth and quiet operation.

3.5 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other within 1/8 inch. in accordance with ANSI/ASME A17.1 and ANSI/ASME A17.2.

B. Cab Movement on Aligned Guide Rails: Smooth movement, with no objectionable lateral or oscillating movement or vibration.

3.6 TESTS BY REGULATORY AGENCIES

A. Testing by regulatory agencies will be performed at their discretion; documented by the Contractor under provisions of Section 01400.

B. Obtain required permits to perform tests. Perform tests required by regulatory agencies.

C. Schedule tests with agencies and Owner, and Contractor present.

D. Furnish test and approval certificates issued by jurisdictional authorities.

3.7 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.

B. Adjust automatic floor levelling feature at each floor to achieve 1/4 inch from flush.

3.8 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components ready for inspection.

3.9 PROTECTION OF FINISHED WORK

A. Do not permit construction traffic within cab after cleaning.

END OF SECTION

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical requirements that are applicable to all Division 15 sections in addition to Division 0 - Contract Requirements and Division 1 - General Requirements.

B. Mechanical work covered by all sections within DIVISION 15 - MECHANICAL of these Specifications, including but not limited to:

1. Heating, ventilating, air conditioning and refrigeration systems and equipment.
2. Plumbing systems and equipment.
3. Fire protection systems and equipment.]

1.2 RELATED SECTIONS

A. Division 0 - Contract Requirements

B. Division 1 - General Requirements

C. Division 3 - Concrete

D. Division 9 - Finishes

E. Division 11 - Equipment

F. Division 13 - Section 13080 - Seismic Protection for Mechanical, Electrical Equipment

G. Division 12 - Furnishings

H. Division 14 - Conveying Systems

I. Division 16 - Electrical

J. Divisions 1 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS: These shall apply to all work included in this section. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this and the other sections of

Division 15.

K. This section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Reference Standards, Codes and Fees
2. Quality Assurance
3. Submittals
4. Maintenance Manuals
5. Job Conditions
6. Accuracy of Data and Drawings
7. Electrical Requirements for Mechanical Equipment
8. Coordination Drawings
9. Record Documents
10. Identification
11. Fire-Stop Materials
12. Rough-ins
13. Field Tests
14. Excavation nd Backfill
15. Adjusting and Cleaning
16. Installation
17. Removal and Relocation of Existing Work
18. Painting

1.3 CONTRACTOR'S RESPONSIBILITY

A. Refer to Section 01000.

B. The Contractor shall obtain and pay for all licenses and permits required to perform work covered by DIVISION 15 - MECHANICAL, and obtain and pay for all necessary inspections by all applicable authorities.

1.4 CODES AND STANDARDS

Select related codes or standards.

A. In addition to requirements of Divisions 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS, all work shall be manufactured, installed and labeled in accordance with the applicable provisions of the latest editions of the following codes and standards, including addenda and modifications made by local authorities.

1. Local Codes
2. State Codes
3. Federal Codes
4. ASME Boiler Code
5. AGA - American Gas Association
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. AABC - Associated Air Balance Council
8. NEMA - National Electrical Manufacturer's Association
9. ANSI - American Society National Standards Institute
10. ASME - American Society of Mechanical Engineers
11. NFPA - National Fire Protection Association
12. NFPA - 101 Life Safety Code
13. ARI - Air-Conditioning and Refrigeration Institute
14. UL - Underwriters Laboratories, Inc.
15. BOCA National Codes - Building, Mechanical, Plumbing, Fire Prevention, Existing Structures, Sewage Disposal, Energy, Etc.
16. SBCCI Standard Codes - Building, Mechanical, Plumbing, Fire Prevention, Energy Conservation Etc.
17. Uniform Codes - Building, Mechanical, Plumbing, Fire Prevention, Etc.
18. National Codes - Building Mechanical, Plumbing, Fire Prevention, Etc.
19. ASPE - American Society of Plumbing Engineers.
20. OSHA - Occupational Safety and Health Act.
21. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc. 1985 HVAC Duct Construction Standards.

1.5 QUALITY ASSURANCE

A. The use of manufacturer's names and catalog numbers in these specifications or on the drawings indicates the type, size, rating, capacity, design, quality, or kind of materials required and a closed specification is not intended, and similar and equal products of any reputable manufacturer which will satisfactorily perform the required functions will be acceptable, unless otherwise indicated by the words NO SUBSTITUTES, or unless otherwise specifically stated. The Architect/Engineer reserves the right to reject all materials which he deems not equal to those specified, or which he decides will not satisfactorily perform the required functions.

B. Supply all equipment and accessories new and free from defects.

C. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

D. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.4 of this section and with all applicable national, state, and local codes.

E. When included, reflected ceiling plan drawings shall govern over mechanical and electrical drawings for location of ceiling-mounted elements.

F. In addition to all requirements specified hereinafter, each material and equipment item shall have all features as standard with its manufacturer and/or required for the complete operational system.

G. Capacities, ratings, sizes and other requirements not specified hereinafter shall be as scheduled or otherwise indicated on the drawings.

H. Should the Trade Contractor at any time discover a discrepancy between engineering and architectural drawings or with respect to a variance of code requirements, he shall notify the Architect/Engineer for clarification and shall not proceed with the work affected until clarification has been made.

1.6 SUBMITTALS

A. Submittals shall be provided to the Engineer as described in Section 01300.

B. Submittals and shop drawings shall be submitted in accordance with Divisions 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS and in accordance with the following.

1. Carefully review the requirements of DIVISIONS 0 and 1.
2. All equipment, material, and manufacturer's literature shall be submitted for approval at one time and in a tabulated high quality 3 ring binder. Control drawings and the controls equipment submittal may be submitted at a later time, but as

soon as practical after the contract has been awarded and after the general equipment submittal has been made. However, every attempt shall be made to include the complete controls submittal with the general equipment submitted at one time.

3. The submittal shall include summary cover sheet(s) and manufacturer's literature under each tab of the submittal binder which together clearly indicate compliance or deviation from the specifications and drawings. Each submittal brochure shall be signed, on the index page, by Contractor. This signature shall indicate the Contractor has examined all data therein and found same to be in order.
4. Submission material and all shop drawings shall be marked up with the appropriate identification relating the equipment to the drawings. Mark and reference each item on the submittal summary sheet and the manufacturer's literature to the appropriate paragraph number in the specifications. Manufacturer's standard catalogs will not be accepted.
5. Failure to comply with the above for a complete and clear submittal will result in resubmittal.
6. A minimum of (7) copies of all submittals shall be provided of which (3) will be returned to the Owner by the Contractor, (2) will be retained by the A/E, and (2) will be available for Contractor's use.

C. Maintenance Manuals:

1. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for each equipment item. Behind a separate tab for each piece of equipment, provide the following:

   a. A copy of the equipment submittals and shop drawings as provided in (A) above.
   b. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   c. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency

instructions; and summer and winter operating instructions, as applicable.

d. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

e. Servicing instructions and lubrication charts and schedules.

2. Before requesting acceptance of work, furnish the number of printed and bound sets required in DIVISIONS 0 and 1.

3. Detailed and simplified one line, color coded flow and wiring diagrams.

4. Schedule of valve identification.

5. Provide seven copies of all manuals.

D. Field test report: required by Section 15990 - BALANCING AND TESTING BY INDEPENDENT AGENCY. Provide seven copies.

1.7 JOB CONDITIONS

A. Examine related work and surfaces before starting work of any section.

1. Report to Contracting Officer, in writing, conditions which will prevent proper provision of this work.

2. Installed work which interferes with architectural or any other work, or which deviates from drawings and specifications without Architect's prior approval, shall be altered by DIVISION 15 - MECHANICAL, without cost to the Owner, to clear such interferences, or to comply with the drawings and specifications. Interferences or discrepancies which may be discovered or anticipated shall be reported promptly to Architect for his decision before proceeding with the work involved. Architect shall have privilege of making minor changes without additional cost, provided that such changes are made before commencing work on items involved.

1.8 ACCURACY OF DATA AND DRAWINGS

A. Drawings are generally diagrammatic, and where not dimensioned or detailed, indicate approximate locations of work. Examine carefully existing buildings and structures, existing systems, and all other contract drawings, and install work to conform as nearly as possible to locations and arrangements indicated, with only such minor adjustments as necessary to coordinate work with architectural and other work, and to avoid interferences therewith. All piping and ductwork, offsets, risers, and fittings are not necessarily shown; however, provide these as required by the conditions involved.

B. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND STRUCTURAL DRAWINGS, AND FROM ACTUAL MEASUREMENTS MADE BY AC SECTION OF EACH EXISTING BUILDING AND EACH EXISTING STRUCTURE INVOLVED.

1.9 ELECTRICAL CHARACTERISTICS, MOTOR SIZES, MOTOR STARTERS, CONTROLS, AND WIRING

A. DIVISIONS 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS: These shall apply to the work related in this section.

B. Motor starters and other electrical control devices: Generally, motor starters for equipment motors shall be furnished by DIVISION 16 - ELECTRICAL; however, this section shall furnish ONLY those motor starters which may be specified hereinafter in this Section. Also, this section shall furnish all other electrical control devices required for the Mechanical system, unless otherwise specified.

C. Installation of electrical devices, EXCEPT those factory mounted on equipment: electrical control devices which require electrical connections ONLY, shall be installed by DIVISION 16 - ELECTRICAL. All control devices which are not factory mounted on the equipment and require piping, linkage, remote bulb, or other mechanical connections as well as electrical connections shall be installed by the Section that furnished the equipment involved, ready for electrical connection.

1. Electric wiring: Division 15 shall perform any and all control and interlock wiring necessary for the operation sequence described in Section 15950 or on

mechanical plans with properly licensed personnel. Any wiring requirements for control devices furnished under Division 15 shall be provided by Division 15. Wiring for control devices not furnished by Division 15 or devices that are factory mounted on mechanical equipment requiring electrical connections only shall be by Division 16. Division 16 shall provide dedicated 120 VAC, 15-20 amp power to designated control panel locations. Exact locations shall be coordinated between Division 15 and 16.

2. All necessary interlocking contacts and remote starting contacts and remote starting devices not installed on local control panels shall be supplied with the starters and it shall be the responsibility of Division 15 to coordinate the number of contacts required. If individual control transformers are required, provide the transformers necessary for the additional power required by auxiliary control devices. This coordination shall occur prior to ordering starters and the cost shall be included in the bid proposal.
3. Control wiring materials and installation shall conform to Division 16 requirements.

1.10 COORDINATION DRAWINGS

A. Refer to Section 01440.

B. Prepare coordination drawings in accordance with Division 1 Section "PROJECT COORDINATION," to a minimum scale of 1/4" = 1'-0" or larger if required in Division 1; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of piping, ductwork, equipment, and materials in all mechanical equipment rooms. Include the following:

a. Clearances for installing and maintaining insulation.
b. Clearances for servicing and maintaining

equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

c. Equipment connections and support details.
d. Exterior wall and foundation penetrations.
e. Fire-rated wall and floor penetrations.
f. Sizes and location of required concrete pads and bases.

2. Project drawings for mechanical and plumbing systems shall be made available to the contractor in Microstation format for use in coordination drawings.

1.11 PROJECT RECORD DOCUMENTS

A. Refer to Section 01440.
B. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT RECORD DOCUMENTS." In addition to the requirements specified in Division 1, indicate the following installed conditions:
1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.) Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
5. Contract Modifications, actual equipment and materials installed.
6. These documents shall be prepared in Microstation format and provided with project closeout documentation in disk and hard copy format.

PART 2 - PRODUCTS

2.1 HOUSEKEEPING PADS

A. Provide 4" concrete pads for all floor mounted mechanical equipment such as circulating pumps, chillers, air handling units, etc. Pad dimensions shall be approximately 6 inches larger than the equipment in the width and depth dimensions. Bevel the edges of the pad to reduce chipping. Refer to section 03300 for concrete specifications.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 FIELD TESTS

A. Perform field tests in accordance with Section 01451 TESTING FOR MECHANICAL AND ELECTRICAL SYSTEMS and the following:

B. All piping shall be free of leaks, and test gauges shall show no loss of pressure for at least 30 minutes, after source of test pressure has been cut off, or as noted. Pipes may be tested in sections as the work progresses. Repair and retest all sections failing to pass tests, as required to obtain approval of tests. No caulking, welding or brazing will be permitted on threaded pipe or fittings to stop leaks. Replace with new material all cracked or otherwise defective pipe and fittings of all types, as approved. Furnish suitable testing equipment, give the Architect/Engineer and all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal or insulate piping and do not conceal ductwork until all inspections have been made and all required tests have been approved by the Architect/Engineer and all applicable authorities.

Submit results for review.

C. Provide required labor, material, equipment and connections.

D. Test all piping, EXCEPT as otherwise specified below, as follows: hydrostatic test, at 150 percent of normal operating pressure of piping involved, or 100 psi (690 kpa), whichever is higher, AFTER removing all air from piping involved in test.

1. Natural gas and fuel oil piping: 50 psi (345 kpa) test using air or inert gas.
2. Soil, waste, vent roof drainage, and acid waste piping: standard water test, by filling piping with water up to top of vent stack or highest point of piping test section involved, but no section tested with less than a ten foot head with no pressure loss for at least 30 minutes.
3. Compressed air: air test at 150 percent of normal working pressure of piping involved, or 100 psi (690 kpa), whichever is higher.
4. Fire protection piping: 200 psi (1380 kpa) two hour duration hydrostatic test, AFTER removing all air from piping involved in test, with pressure gauged at bottoms of standpipes. Conduct this test in presence of authorized representative of the Fire Department having jurisdiction.
5. Chilled water and heating water piping: Water test at 150% of normal working pressure of piping involved, or 100 psig (690 kpa), whichever is higher.
6. Test all equipment in accordance with sections specified hereinafter.

E. Test all ductwork constructed to 1" (250 pa) W.G. class or higher, in accordance with leakage test method recommended in 1985 SMACNA "Duct Construction Standards". After remedying audible leaks, total leakage on system shall not exceed one percent of system total design air flow rate.

3.3 EXCAVATION AND BACKFILL

A. Excavation, Underground Pipework:

1. Cut trenches to indicated and/or required lines, and to depths which will:

a. Provide full length bearing of pipe barrels on firm ground.
b. Provide 24 inch (610 mm) MINIMUM earth cover over all pipes outside of buildings and structures.

2. Piping shall be laid on a six inch (152 mm) bed of sand and backfilled with 12 inches (305 mm) of sand in six inch (152 mm) layers.

3. Seat pipe on sand fill as required to facilitate jointing, and to prevent pipe hubs, couplings and valves from bearing on sand before backfilling.

4. Sheet and brace excavations as required to prevent cave-ins and protect personnel and adjacent structures.

5. Where pipelines are below footings, horizontal distance between footings and pipelines shall be as required to provide not steeper than a 1:1 slope from footing bottoms to trench bottoms at all points.

B. Backfill, Trenches

1. After each pipeline has been laid, tested and approved, thoroughly hand tamp backfill into bell holes, around pipe, and up to six inches (152 mm) above pipe top.
2. Place remaining backfill in 8 inches (203 mm) maximum thickness loose layers, and with pneumatic or other suitable power tampers compact each layer to the backfill density specified in Section 02222 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS.
3. Backfill materials shall be of the following types:

a. Up to six inches (152 mm) above pipe tops: sand, ONLY.
b. From six inches (152 mm) above pipe tops up to finished grade or subgrade, as required.
(1) Any materials removed from the excavation and suitable for backfill, except do no use as backfill material any pieces of the following material which are larger than six inches in their greatest dimensions: rock, stone, concrete, asphalt paving, or

masonry.
(2) Dispose of excavated materials which are not replaced as backfill, as approved.

C. Excavation and Backfill for Structures Related to Mechanical Work

1. This shall conform to applicable requirements in Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS.

D. Unsuitable Subsurface Conditions

1. Where excavation bottoms at required elevations are found to be unstable, or where rock, cinders, rubbish, or other deleterious materials are encountered, extend excavations down to firm earth, but at least 6 inches (152 mm) below deleterious materials.
2. Bring excavation bottoms back up to required pipe laying subgrade by backfilling with suitable material, thoroughly compacted in place as specified above.
3. "Suitable material" shall be as specified above.
4. Dispose of excavated unsuitable subgrade materials, as approved.

E. Warning Tape for Buried Pipeline: Install detectable warning tape directly over every pipeline by burying tape as close to the surface as possible, but no less than 6 inches (152 mm) beneath finished grade.

3.4 ADJUSTING AND CLEANING

A. Flush or blow all welding slag, pipe joint compound, loose scale, and other debris from pipework before connecting equipment thereto.

B. After systems have been tested and before any field painting is commenced, clean up all work thoroughly. Remove all foreign matter which has accumulated in ducts, casings, enclosures, fixtures, and equipment. Clean and polish all valves, plates, and other surfaces that are not to be painted, so that they present a new and acceptable appearance.

C. Put systems in operation, test all fixtures and other equipment, remedy all leaks and defects, make all

necessary adjustments, and remove all air from water circulating systems. Adjust all air and water flows to indicated and/or required quantities, and adjust all controls and other items as required to balance system and provide uniform air flows and uniform temperatures in air conditioned areas. Demonstrate that all controls and mechanical equipment function satisfactorily, as specified, as indicated, and as approved.

D. Sterilization of Domestic Water System: AFTER all water connections have been made to all fixtures and equipment, and BEFORE plumbing system is used by Owner, sterilize entire potable water system as specified below, and submit a written report certifying that this has been done in accordance with the requirements of the State Department of Public Health.
   1. Drain entire water system.
   2. Refill entire water system with a sterilizing solution of potable water containing at least 50 parts per million of available chlorine.
   3. Allow sterilizing solution to remain in water system for at least 24 hours, then drain all sterilizing solution from water system.
   4. With potable water, flush all traces of sterilizing solution from entire water system through each fixture and each water outlet.

E. Strainers and Dirt Pockets: Clean out each of these; REMOVE EACH STRAINER SCREEN FOR CLEANING. Initially install very fine mesh screen for system cleaning and operate System to a minimum of 24 hours. Remove screen, clean it and replace it in system until a clean system is verified. Remove screen and replace with screen at mesh for normal operation.

F. Circulating Water Systems: Completely drain each of these, and refill with clean water.

G. Compressed air and medical gas piping shall be cleaned in accordance with the requirements of Section 15481 - COMPRESSED AIR SYSTEM.

H. After systems have been tested and before putting any part of or the entire system in operation for Owner's beneficial use, insure that all necessary adjustments have been made.

1. Bearings and other items requiring lubrication, except factory permanently lubricated type: lubricate each of these as recommended by its manufacturer; this includes lubricated type plug valves.
2. Belts: adjust each of these to proper tension.
3. Filters: replace each disposable ("throw away") filter with a new clean filter (except blanket roll and high efficiency type). Clean each cleanable filter. NOTE: ALL FILTERS SHALL BE IN PLACE DURING TESTING AND ADJUSTING AND SHALL BE CLEAN.
4. Motor load tests: make an ammeter check of actual running current of each motor in mechanical system under operating conditions. Correct all motors which are found to be overloaded, as approved.

3.5 INSTALLATION

A. General: Sequence, coordinate and integrate the various elements of mechanical systems, materials, and equipment.

B. Equipment rooms and other areas in which equipment is to be installed have limiting dimensions. Coordinate mechanical systems, equipment, and materials installation with other building components. Install all mechanical work within these areas substantially as indicated, with ample unobstructed access space around each piece of equipment to facilitate proper installation, operation, and maintenance of equipment, and to allow ample space for plumbing, electrical, and other equipment indicated to be installed therein. Minor revisions in layout may be made subject to Contracting Officer’s approval, but major changes in layout to accommodate proposed equipment which differs substantially from specified equipment in size and arrangement will not be considered. Each bidder shall determine before bidding that equipment upon which he proposes to base his bid will conform to these requirements. Install each equipment item in accordance with its manufacturer's recommendations, and as indicated on the drawings, and/or specified. If the drawings and/or specifications conflict with the manufacturer's recommendations, report this to the Contracting Officer for his decision before proceeding with the work involved.

C. Equipment NOT furnished by mechanical section but

requiring mechanical connections from other Sections and others furnishing this equipment, determine exact mechanical connection requirements therefor; locations and arrangements of connections indicated for this equipment are APPROXIMATE ONLY.

D. Arrange for chases, slots and openings in other building components during progress of construction, to allow for mechanical installations.

E. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

F. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.

G. Where installation heights are not detailed or dimensioned, and equipment requires periodic service, verify height with Owner and/or Architect prior to installation, otherwise install to provide the maximum headroom possible.

H. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.

I. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

J. Install systems, materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.

K. Generally, install pipework and ductwork as follows unless otherwise indicated.

1. Finished areas: conceal pipework and ductwork within pipe chases, above suspended ceiling and within other building construction, in offices, rest rooms, and other finished areas, unless otherwise indicated.
2. Unfinished areas: install above ground pipework and ductwork exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms or storage areas, and other unfinished areas.
3. ALL areas: install pipework and ductwork parallel or at right angles with beams, walls, ceilings, and other building lines, in straight lines between required direction changes, with vertical runs plumb. Install exposed pipework and ductwork as close as practicable to walls, columns, ceilings, and overhead construction, and to provide maximum headroom and minimum interference with usable building space.

3.6 REMOVAL AND RELOCATION OF EXISTING WORK

A. Disconnect, remove or relocate material, equipment, piping, and other work noted and required by removal or changes in existing construction.

B. Provide new material and equipment related to relocated equipment.

C. Plug or cap active piping or ductwork behind or below finish, except as otherwise specified.

D. Do not leave long dead end branches:

1. Cap or plug as close to active line as possible.

E. Salvaged Existing Mechanical Materials and Equipment: Promptly haul away from Owner's premises all materials and equipment which are removed from existing system and are neither indicated nor required to be reused in the completed project, EXCEPT as otherwise specified. Owner may select certain removed existing materials and equipment and retain them for his future use. Before removing any existing materials and equipment, determine from Owner which of these materials and equipment he desires to retain. Remove all Owner selected materials and equipment with unnecessary

damage thereto, and safely store them at locations designated by Owner.

3.7 PAINTING

A. All surfaces shall be left clean and free from oil.

B. All equipment shall be factory prime coated and painted; however, the following may be shop prime coated and made ready for painting:
1. Tanks.
2. Structural supports and frames.

C. Where galvanizing is broken during fabrication or installation, recoat exposed areas with cold galvanizing compound.

D. Uncoated Hangers, Supports, Rods, and inserts shall be prime coated.

E. Exposed, uninsulated black steel piping, pipe supports, and pipe braces shall be prime coated.

F. All ductwork, conduit, insulation, pipe, and structures visible through grilles and diffusers shall be painted flat black.

G. Marred surfaces of prime coated or factory painted surfaces shall be painted and/or primed to match adjacent coat.

H. Provide enamel paint where specified.

I. Refer to Section 09900 for Painting.

3.8 IDENTIFICATION OF VALVING AND EQUIPMENT

A. Identify valves, (including main pipe sectionalizing valves and branch valves) except those on or within hand reach of equipment controlled thereby with a minimum 1-1/2 inch (38 mm) diameter round brass or aluminum tag stamped with 1/4 inch (6 mm) (minimum) height letters designating material controlled by valve, and attached to valve body with 18 (minimum) gauge (1.3 mm) solid copper or galvanized steel wire. Submit a typed valve identification schedule with the operating instructions and parts list submittal described above under article 1.12 SUBMITTALS AND SHOP

DRAWINGS.

B. Equipment: Label each major mechanical equipment item (such as AHU, pump, fan, condensing unit, boiler, water heaters, etc.) with nameplate engraved with equipment designation and number, and securely attached to equipment.

C. Refer to Section 15190 for Mechanical Identification.

3.9 IDENTIFICATION OF PIPING

A. Identify piping with self-sticking vinyl cloth pipe markers and pipe marker arrows, each sized as recommended by marker manufacturer for outside diameter of pipe (including pipe insulation) labeled therewith. Marker background colors shall conform to OSHA, NFPA and ANSI pipe identification standards as scheduled in Table (I). Each pipe marker shall be lettered to indicate the material contained in the pipeline involved and arrows shall indicate direction of material flow in the pipelines.

B. Provide a full color piping Identification Schedule indicating material type within pipe and its corresponding color coding.

C. Locate Identification As Follows:

1. Mechanical Equipment Rooms:

a. Within 1'-6" (0.46m) of each valve or valve assembly.
b. Within 3'-0" (0.92m) of each 90 deg (1.57 Rad) elbow, connection to equipment or vessel, point where pipe enters shafts and pierces outside walls.
c. On not over 20'-0" (6.1 m) intervals along all exposed piping.

2. Above Suspended Ceilings:

a. Within 1'-6" (0.46 m) of each valve or valve assembly.
b. At tees within 3'-0" (0.92 m) of both main and branch.
c. Within 3'-0" (0.92 m) of each 90 deg (1.57 Rad) elbow.

3. Piping Concealed in Chases or Shafts:

   a. Each pipe visible through an access door or panel.

4. Piping Exposed in Rooms Other than Mechanical Equipment Areas:

   a. Omit identification of piping, 1/2" (13 mm) and smaller, exposed at connections to equipment or plumbing fixtures.
   b. With the above exception, identify at not less than (1) point each piping run visible in each room with identification on not over 20'-0" (6.1 m) intervals.

D. Refer to Section 15190 for Mechanical Identification.

TABLE I
SCHEDULE OF PIPING IDENTIFICATION

CLASSIFICATION (Per ANSI A13.1)	BACKGROUND COLOR	LETTERING
Chilled Water Supply from Chiller	Green	White
Chilled Water Return to Chiller	Green	White
Domestic Cold Water	Green	White
Domestic Hotwater Supply	Green	White
Domestic Hotwater Return	Green	White
Equipment Drains, Roof Drains	Green	White
Sanitary Drains, Storm Drains	Green	White
Fire Protection Water	Red	White
Hot Water Supply From Boiler	Yellow	Black
Hot Water Return to Boiler	Yellow	Black
Plumbing Vent Lines	Green	White
Condenser Water Return	Green	White
Fuel Oil Supply	Green	Black
Fuel Oil Return	Yellow	Black
Fuel Oil Vent	Yellow	Black
Compressed Air	Blue	White

3.10 FIRE-STOP MATERIALS

A. Seal around all pipes, ducts, and conduit penetrating fire-rated partitions, in accordance with manufacturer's instructions. Caulk and putty shall be applied to the proper depth for the fire rating required, as listed in the manufacturer's instructions.

END OF SECTION 15010

SECTION 15121

PIPING EXPANSION COMPENSATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.2 RELATED SECTIONS

A. Division 13 - Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15310 - Fire Protection Piping.

C. Section 15410 - Plumbing Piping.

D. Section 15510 - Hydronic Piping.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASTM A 36/A 36M - Specification for Structural Steel.

B. ASTM A 53 - Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.

C. ASTM A 183 - Carbon Steel, Track Bolts and Nuts.

D. ASTM A 780 - Repair of Damaged Hot-Dipped Galvanized Coatings.

E. ASTM F 844 - Washers, Steel, Plain (Flat), Unhardened for General Use.

F. ASME B18.10 - Track Bolts and Nuts.

G. ASME B31.9 - Building Services Piping.

H. ASME Boiler & Pressure Vessel Code Section II "Material Specifications" And Section IX "Welding and Brazing Qualifications".

I. AWS D1.1 - Structural Welding code - Steel.

J. EJMA Standards.

K. SSPC - PA - Paint Application Specification No. 1, Shop, Field, and Maintenance Painting.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

B. Expansion Calculations:
1. Installation Temperature: 50 degrees F.
2. Hot Water Heating: 210 degrees F (99 degrees C).
3. Domestic Hot Water: 140 degrees F (60 degrees C).
4. Safety Factory: 30 percent.

C. Seismic Considerations:
1. Fabricate and install expansion and anchor system capable of sustaining forces generated by gravity, thermal movement, and seismic events.
2. Design and obtain approval from authority with jurisdiction, seismic restraints for pipe expansion joints and pipe anchor system.
3. Design and prepare drawings and calculations for seismic restraint of pipe expansion joints, pipe alignment guides, and pipe anchors. Include seal and signature of Registered Engineer, licensed in jurisdiction where project is located.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300 and 15010.

B. Product Data:
1. Flexible Pipe Connectors: Provide schedule which shows manufacturer's figure number, size, location and indicates maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Provide schedule which shows manufacturer's figure number, size, location, and

indicates maximum temperature and pressure rating, and maximum expansion compensation.

C. Welders Certificates: Contractor shall sign welders certificates, certifying that welders comply with requirements specified under Qualifications.

D. Design Data: Indicate selection calculations.

E. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010 "Project Closeout".

B. Maintenance Data: Include adjustment instructions for each type pipe expansion joint specified.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Design expansion compensating system under direct supervision of a Professional Engineer experienced in design of this work and licensed in jurisdiction where project is located.

C. Qualify welding processes and welding operators according to AWSDI.1 "Structural Welding Code - Steel".

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code,"

Section IX, "Welding and Brazing Qualifications".

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. Provide five year warranty under provisions of Section 01000 and 15010.

B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide two 12 ounce (340 gm) containers of packing lubricant and cartridge style grease gun.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Steel Piping:

1. Acceptable Manufacturers:

a. Mason Industries, Inc.
b. Senior Flexonics, Inc.
c. Proco Products, Inc.
d. Hyspan Precision Products, Inc.
e. Twin City Hose, Inc.
f. Metraflex Company

2. Inner Hose: Stainless Steel.
3. Exterior Sleeve: Single braided, stainless steel.

4. Pressure Rating: 125 psig (862 kPa) WSP and 450 degrees F (232 degrees C)
5. Joint: As specified for pipe joints.
6. Size: Use pipe sized units.
7. Maximum offset: 3/4 inch (19 mm) on each side of installed center line.

B. Copper Piping:

1. Acceptable Manufacturers:

   a. Mason Industries, Inc.
   b. Senior Flexonics, Inc.
   c. Proco Products, Inc.
   d. Hyspan Precision Products, Inc.
   e. Twin City Hose, Inc.
   f. Metraflex Company

2. Inner Hose: Bronze
3. Exterior Sleeve: Braided bronze.
4. Pressure Rating: 125 psig (862 kPa) WSP and 450 degrees F (232 degrees C).
5. Joint: As specified for pipe joints.
6. Size: Use pipe sized units
7. Maximum offset: 3/4 inch (19 mm) on each side of installed center line.

2.2 EXPANSION JOINTS

A. Stainless Steel Bellows Type:

1. Acceptable Manufacturers:

   a. Mason Industries, Inc.
   b. Senior Flexonics, Inc.
   c. Proco Products, Inc.
   d. Hyspan Precision Products, Inc.
   e. Twin City Hose, Inc.
   f. Metraflex Company

2. Pressure Rating: 125 psig (862 kPa) WSP and 400 degrees F (204 degrees C).
3. Maximum Compression: 1-3/4 inch (45 mm).
4. Maximum Extension: 1/4 inch (6 mm).
5. Joint: As specified for pipe joints.
6. Size: Use pipe sized units
7. Application: Steel piping 3 inch (76 mm) and under.

B. External Ring Controlled Stainless Steel Bellows Type:

1. Acceptable Manufacturers:

a. Mason Industries, Inc.
b. Senior Flexonics, Inc.
c. Proco Products, Inc.
d. Hyspan Precision Products, Inc.
e. Twin City Hose, Inc.
f. Metraflex Company

2. Pressure Rating: 125 psig (862 kPa) WSP and 400 degrees F (204 degrees C).
3. Maximum Compression: 15/16 inch (24 mm).
4. Maximum Extension: 5/16 inch (8 mm).
5. Maximum Offset: 5/16 inch (8 mm).
6. Joint: Flanged
7. Size: Use pipe sized units
8. Accessories: Internal flow liner.
9. Application: Steel piping over 3 inch (76 mm).

C. Double Sphere, Flexible Compensator:

1. Acceptable Manufacturers:

a. Mason Industries, Inc.
b. Proco Products, Inc.
c. Hyspan Precision Products, Inc.
d. Twin City Hose, Inc.
e. Metraflex Company

2. Body: Neoprene and nylon.
3. Working Pressure: 125 psi
4. Maximum Temperature: 400 degrees F.
5. Maximum Compression: 3/4 inch (19 mm)
6. Maximum Elongation: 1/2 inch (13 mm).
7. Maximum Offset: 1/2 inch (13 mm).
8. Maximum Angular Movement: 30 degrees (0.52 rad)
9. Joint: Tapped steel flanges.
10. Size: Use pipe sized units
11. Accessories: Control rods.
12. Application: Steel piping 2 inch (51 mm) and over.

D. Two-Ply Bronze Bellows Type:

1. Acceptable Manufacturers:

a. Mason Industries, Inc.

b. Senior Flexonics, Inc.
c. Proco Products, Inc.
d. Hyspan Precision Products, Inc.
e. Twin City Hose, Inc.
f. Metraflex Company

2. Construction: Bronze with anti-torque device, limit stops, internal guides.
3. Pressure Rating: 125 psig (860 kPa) WSP and 400 degrees F (204 degrees C).
4. Maximum Compression: 1-3/4 inch (45 mm).
5. Maximum Extension: 1/4 inch (6 mm).
6. Joint: As specified for pipe joints.
7. Size: Use pipe sized units
8. Application: Copper piping.

E. Low Pressure Compensator with Two-Ply Bronze Bellows:

1. Acceptable Manufacturers:

a. Mason Industries, Inc
b. Senior Flexonics, Inc.
c. Proco Products, Inc.
d. Hyspan Precision Products, Inc.
e. Twin City Hose, Inc.
f. Metraflex Company

2. Working Pressure: 75 psig (510 kPa).
3. Maximum Temperatures: 250 degrees F (121 degrees C).
4. Maximum Compression: 1/2 inch (12.7 mm).
5. Maximum Extension: 5/32 inch (4.0 mm).
6. Joint: Soldered
7. Size: Use pipe sized units
8. Application: Copper or steel piping 2 inch (51 mm) and under.

2.3 ACCESSORIES

A. Pipe Alignment Guides:

1. Acceptable Manufacturers:

a. Grinnell Corp.
b. B-Line Systems, Inc.
c. Michigan Hanger Co.

2. Two piece welded steel with enamel paint, bolted,

with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch (25 mm) thick insulation, minimum 3 inch (76 mm) travel.

B. Swivel Joints:

1. Acceptable Manufacturers:

a. Advanced Thermal Systems, Inc.
b. Barco Div., Marison Indust.,

2. Ductile Iron body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Work shall be installed as shown and in accordance with manufacturer's instructions, diagrams and recommendations.

B. Construct spool pieces to exact size of flexible connection for future insertion.

C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Install pipe anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9, and to prevent transfer of loading and stresses to connected equipment.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

G. Install pipe anchors according to expansion unit

manufacturer's written instructions to control movement to compensators.

H. Where not otherwise indicated, install pipe anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Preset anchors as required to accommodate both expansion and contraction of piping.

I. Pipe alignment guides shall be installed as recommended by joint manufacturer, but in any case shall not be more than 5 feet (1.52m) from an expansion joint except for lines 4 inches (100mm) or smaller, where guides shall not be more than 2 feet (0.61m) from the joint.

3.2 PAINTING

A. Touching up:

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting".
2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Sections 01000 and 15010.

B. Provide inspection services by flexible pipe manufacturer's representative for final installing and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

C. Prepare report covering installation of pipe expansion joints, pipe alignment guides, and pipe anchors. Include seal and signature of Registered Engineer licensed in jurisdiction where project is located, certifying compliance with specifications.

END OF SECTION 15121

SECTION 15140

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and equipment hangers and supports.

B. Equipment bases and supports.

C. Sleeves and seals.

D. Flashing and sealing equipment and pipe stacks.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03300 -Cast-In-Place Concrete: Placement of sleeves in concrete formwork.

B. Section 07620 - Sheet Metal Flashing and Trim: Placement of roof sleeves, vents, and curbs.

1.3 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete: Equipment bases.

B. Section 09900 - Painting.

C. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

D. Section 15245 - Vibration Isolation.

E. Section 15260 - Piping Insulation.

F. Section 15280 - Equipment Insulation.

G. Section 15310 - Fire Protection Piping.

H. Section 15410 - Plumbing Piping.

I. Section 15510 - Hydronic Piping.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASME B31.1 - Power Piping.

B. ASME B31.2 - Fuel Gas Piping.

C. ASME B31.5 - Refrigeration Piping.

D. ASME B31.9 - Building Services Piping.

E. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

F. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

G. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

H. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

I. NFPA 13 - Installation of Sprinkler Systems.

J. NFPA 14 - Installation of Standpipe and Hose Systems.

K. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

L. ASME B18.10 - Track Bolts & Nuts.

M. ASME Boiler & Pressure Vessel Code Section II "Material Specifications", Parts A, B & C, and Section IX "Welding & Brazing Qualifications".

N. ASTM A 36/A 36M - Specification for Structural Steel.

O. ASTM A 183 - Specification for Carbon Steel Track Bolts & Nuts.

P. ASTM A 780 - Practice for Repair of Damaged Hot-Dipped Galvanized Coatings.

Q. ASTM C33 - Specification for Concrete Aggregates.

R. ASTM C 150 - Specification for Portland Cement.

S. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

T. ASTM F 844 - Specification for Washers, Steel Plain (Flat), Unhardened for General Use.

U. AWS D1.1 - Structural Welding Code - Steel.

V. MSS SP-90 - Guidelines on Terminology for Pipe Hangers & Supports.

W. NFPA 70 - National Electrical Code.

X. SSPC-PA 1 - Paint Application Specification No. 1, Shop, Field, & Maintenance Painting.

1.5 PERFORMANCE REQUIREMENTS

A. Design seismic restraint hangers and supports, for piping and equipment.

1.6 SUBMITTALS

A. Submit under provisions of Sections 01300 and 15010.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers. Submit shop drawings for each type of hanger and support, indicating dimensions, weights, required clearance, and methods of component assembly.

C. Product Data: Provide manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

F. Welder's Certificates: Contractor shall sign welders certificates, certifying that welders comply with requirements specified under Qualifications.

G. Pipe Hanger Schedule: Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable building code for support of plumbing and hydronic piping.

B. Supports for Sprinkler Piping: In conformance with NFPA 13.

1.8 QUALIFICATIONS

A. Qualify welding processes and welding operators according to AWSD1.1 "Structural Welding Code-Steel".
   1. Certify that each welder has satisfactorily passed AWS Qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

C. NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.

D. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.
   1. Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.

E. Use operators that are licensed by power-operated tool manufacturers to operate their tools and fasteners.

F. Licensed Engineer: Prepare hanger and support design drawings, and calculations for seismic restraint of piping and equipment. Include seal and signature of Registered Engineer, Licensed in Jurisdiction where project is located, certifying compliance with specifications.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers:

   1. Grinnell Corp.

2. B-Line Systems, Inc.
3. Michigan Hanger Co.

B. Fire Protection Piping:

1. Conform to NFPA 13.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches (51 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - DWV:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches (51 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Plumbing Piping - Water:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (102 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

E. Hydronic Piping:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (51 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.

6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (102 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
16. Exterior supports shall be the same as above except all items shall be constructed of galvanized steel.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. Acceptable Manufacturers:

1. Grinnell Corp.
2. B-Line Systems, Inc.
3. Michigan Hanger Co.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage (0.6 mm thick) galvanized steel.

B. Metal Counterflashing: 22 gage (0.9 mm thick) galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb/sq ft (24.5 kg/sq m) sheet lead
2. Soundproofing: 1 lb/sq ft (5 kg/sq m) sheet lead.

D. Flexible Flashing: 47 mil (1.2 mm) thick sheet butyl.

E. Caps: Steel, 22 gage (0.9 mm) minimum; 16 gage (1.6 mm) at fire resistant elements.

2.5 EQUIPMENT CURBS

A. Acceptable Manufacturers shall be same as that of equipment to be supported.

B. Fabrication: Welded 18 gage (1.3 mm) galvanized steel shell and base, mitered 3 inch (76 mm) cant, 1-1/2 inch (38 mm) thick insulation, factory installed wood nailer.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.3 mm thick) galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.3 mm thick) galvanized steel.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

F. Firestopping Insulation: Glass fiber type, non-combustible.

G. Sealant: Acrylic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Specific hanger and support requirements are specified in the section specifying the equipment and systems.

C. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3.2 INSERTS AND ATTACHMENTS

A. Install building attachments within concrete or to structural steel. space attachments within maximum piping span length indicated in MSS SP69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms. Install reinforcing bars through openings at top of inserts.

B. Provide inserts for placement in concrete formwork. Install concrete inserts in new construction prior to placing concrete.

C. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

D. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (102 mm).

E. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

F. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

G. Install powder actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use

operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (102 mm) thick.

H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (102 mm) thick.

3.3 PIPE HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and SP-89 for hanger selections, applications and maximum spacing. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Support horizontal piping as scheduled.

C. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

D. Place hangers within 12 inches (305 mm) of each horizontal elbow.

E. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Field fabricated heavy-duty steel trapezes shall be from ASTM A36 steel shapes selected for loads being supported. Weld steel according to AWSD-1.1.

I. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

J. Support riser piping independently of connected

horizontal piping.

K. Provide copper plated hangers and supports for copper piping.

L. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units, without disengagement of supported pipe.

M. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

N. Support fire protection systems piping independent of other piping.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

P. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including any spacers, to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation to match adjoining pipe insulation.
3. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees (3.1 rad).

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 6 inches (152 mm) thick and extending 6 inches (152 mm) beyond supported equipment. Refer to Section 03300.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Fabricate structural steel stands to suspend equipment

from structure above or support equipment above floor.

D. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

E. Provide rigid anchors for pipes after vibration isolation components are installed.

F. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

3.5 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches (76 mm) minimum above finished roof surface with lead worked 1-inch (25 mm) minimum into hub, 8 inches (203 mm) minimum clear on sides with 24 x 24 inches (610 x 610 mm) sheet size. For pipes through outside walls, turn flanges back into wall and calk, metal counterflash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches (254 mm) clear on sides with minimum 36 x 36 inch (914 x 914 mm) sheet size. Fasten flashing to drain clamp device.

D. Seal shower drains watertight to adjacent materials.

E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

F. Provide curbs for mechanical roof installations 14 inches (350 mm) minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

G. Adjust storm collars tight to pipe with bolts; calk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors 1 inch (25 mm) above finished floor level, and caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and calk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.7 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections to that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.8 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads

equally on attachments and to achieve indicated slope of pipe.

3.9 PAINTING

A. Touching Up

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting".
2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.10 FIELD QUALITY CONTROL

A. Licensed Engineer's Report: Prepare hanger and support installation report. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

3.11 HANGER SCHEDULE

PIPE SIZE Inches (mm)	MAX. HANGER SPACING Feet (m)	HANGER ROD DIAMETER Inches (mm)
1/2 to 1-1/4 (18 to 32)	6.5 (2.0)	3/8 (10)
1-1/2 to 2 (38 to 51)	10 (3.0)	3/8 (10)
2-1/2 to 3 64 to 76)	10 (3.0)	1/2 (13)
4 to 6 (102 to 152)	10 (3.0)	5/8 (16)
8 to 12 (203 to 305)	14 (4.3)	7/8 (22)
14 and Over (356 and Over)	20 (6.1)	1 (25)
PVC (All Sizes)	6 (1.8)	3/8 (10)

C.I. Bell and Spigot(or No-Hub) and at Joints	5 (1.5)	7/8 (22)

END OF SECTION 15140

SECTION 15170

MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.2 RELATED SECTIONS

A. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.

D. NEMA MG 1 - Motors and Generators.

E. NFPA 70 - National Electrical Code.

F. UL 1004 - Electric Motors.

1.4 SUBMITTALS

A. Submit under provisions of Sections 01300 and 15010.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 5 HP (3.7 KW).

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and

wiring instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Operation Data: Include instructions for safe operating procedures.

C. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture of electric motors for industrial use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Motors and components shall comply with NFPA 70 "National Electrical Code", and shall be NRTL Listed as defined in "National Electrical Code," Article 100. Comply with MENA MG1, "Motors and Generators".

C. Motors and components shall comply with UL 1004, "Motors, Electric."

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable electrical code.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of high efficiency motors.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable

weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.9 WARRANTY

A. Provide five year warranty under provisions of Sections 01000 and 15010.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Baldor Electric Co.

B. Eaton Corp.

C. General Electric Co.

D. MagneTek Inc.

E. A. O. Smith Co.

F. Westinghouse Motor Co.

G. Emerson Electric Co.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer's standard and need not conform to these specifications.

B. Electrical Service:

1. Motors Smaller than 1/2 HP: 115 volts, single phase, 60 Hz.
2. Motors 1/2 HP and larger: 460 volts, three phase, 60 Hz.

C. Type
1. Open drip-proof except where specifically noted otherwise.
2. Motors: Design for continuous operation in 105 degrees F(40 degrees C) environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Motors with frame sizes 254T and larger: Energy

Efficient Type.

D. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

E. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.3 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (120 degrees F (50 degrees C) temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (120 degrees F (50 degrees C) temperature rise) insulation, minimum 1.15 Service Factor, prelubricated ball bearings.

2.4 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (120 degrees F (50 degrees C) temperature rise) insulation, minimum 1.15 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.5 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (120 degrees F (50 degrees C) temperature rise) insulation, NEMA Service Factor, prelubricated ball bearings.

G. Enclosed Motors: Class A (120 degrees F) (50 degrees C) temperature rise) insulation, minimum 1.15 Service Factor, prelubricated ball bearings.

2.6 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 16481 - Motor Starters.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Treated Motors: Epoxy coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 - EXECUTION

3.1 APPLICATION

A. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

B. Single phase motors for fans, pumps, blowers, air compressors: Capacitor start type.

C. Motors located outdoors, draw thru cooling towers, humidifiers, air cooled condensing units: Totally enclosed weatherproof epoxy-treated type.

3.2 INSTALLATION

A. Install in accordance with manufacturer's published instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

D. Mount direct connected motors securely in accurate alignment.

E. Mount belt drive motors using adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer's recommendations.

3.3 COMMISSIONING

A. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.

B. Report any unusual conditions, and correct deficiencies of field-installed units.

3.4 NEMA OPEN MOTOR SERVICE FACTOR SCHEDULE

HP	3600 RPM	1800 RPM	1200 RPM	900 RPM	KW
1/6-1/3	1.35	1.35	1.35	1.35	(0.12-0.25)
1/2	1.25	1.25	1.25	1.15	(0.37)
3/4	1.25	1.25	1.15	1.15	(0.56)
1	1.25	1.15	1.15	1.15	(0.75)
1.5-150	1.15	1.15	1.15	1.15	(1.12-111.85)

3.5 PERFORMANCE SCHEDULE: THREE PHASE - ENERGY EFFICIENT, OPEN DRIP-PROOF

HP	RPM (Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor	(KW)
1	1200	145T	81	72	(0.75)
1-1/2	1200	182T	83	73	(1.12)
2	1200	184T	85	75	(1.50)
3	1200	213T	86	60	(2.24)
5	1200	215T	87	65	(3.73)
7-1/2	1200	254T	89	73	(5.60)
10	1200	256T	89	74	(7.46)
15	1200	284T	90	77	(11.19)
20	1200	286T	90	78	(14.91)
25	1200	324T	91	74	(18.64)
30	1200	326T	91	78	(22.37)
40	1200	364T	93	77	(29.83)
50	1200	365T	93	79	(37.29)
60	1200	404T	93	82	(44.74)
75	1200	405T	93	80	(55.93)
100	1200	444T	93	80	(74.57)
125	1200	444T	93	84	(93.21)
1	1800	143T	82	84	(0.75)
1-1/2	1800	145T	84	85	(1.12)
2	1800	145T	84	85	(1.50)
3	1800	182T	86	86	(2.24)
5	1800	184T	87	87	(3.73)
7-1/2	1800	213T	88	86	(5.60)
10	1800	215T	89	85	(7.46)
15	1800	256T	91	85	(11.19)
20	1800	256T	91	86	(14.91)
25	1800	284T	91	85	(18.64)
30	1800	286T	92	88	(22.37)
40	1800	324T	92	83	(29.83)
50	1800	326T	93	85	(37.29)

60	1800	364T	93	88	(44.74)
75	1800	365T	93	88	(55.93)
100	1800	404T	93	83	(74.57)
125	1800	405T	93	86	(93.21)
150	1800	444T	93	85	(111.85)
200	1800	445T	94	85	(149.14)
1-1/2	3600	143T	82	85	(1.12)
2	3600	145T	82	87	(1.50)
3	3600	145T	84	85	(2.24)
5	3600	182T	85	86	(3.73)
7-1/2	3600	184T	86	88	(5.60)
10	3600	213T	87	86	(7.46)
15	3600	215T	89	89	(11.19)
20	3600	254T	90	89	(14.91)
25	3600	256T	90	92	(18.64)
30	3600	284T	91	91	(22.37)
40	3600	286T	92	92	(29.83)
50	3600	324T	93	89	(37.29)
60	3600	326T	93	91	(44.74)
75	3600	364T	93	88	(55.93)
100	3600	365T	92	88	(74.57)

3.6 PERFORMANCE SCHEDULE: THREE PHASE-ENERGY EFFICIENT, TOTALLY ENCLOSED, FAN COOLED

HP	RPM (Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor	(KW)
1	1200	145T	81	72	(0.75)
1-1/2	1200	182T	83	65	(1.12)
2	1200	184T	85	68	(1.50)
3	1200	213T	85	63	(2.24)
5	1200	215T	86	66	(3.73)
7-1/2	1200	254T	89	68	(5.60)
10	1200	256T	89	75	(7.46)
15	1200	284T	90	72	(11.19)
20	1200	286T	90	76	(14.91)

Modular Design System

Renovate Commissary
for RSC Headquarters
Fort Devens, MA

25	1200	324T	90	71	(18.64)
30	1200	326T	91	79	(22.37)
40	1200	364T	92	78	(29.83)
50	1200	365T	92	81	(37.29)
60	1200	404T	92	83	(44.74)
75	1200	405T	92	80	(55.93)
100	1200	444T	93	83	(74.57)
125	1200	445T	93	85	(93.21)
1	1800	143T	82	84	(0.75)
1-1/2	1800	145T	84	85	(1.1)
2	1800	145T	84	85	(1.5)
3	1800	182T	87	83	(2.24)
5	1800	184T	88	83	(3.73)
7-1/2	1800	213T	89	85	(5.60)
10	1800	215T	90	84	(7.46)
15	1800	254T	91	86	(11.19)
20	1800	256T	91	85	(14.91)
25	1800	284T	92	84	(18.64)
30	1800	286T	93	86	(22.37)
40	1800	324T	93	83	(29.83)
50	1800	326T	93	85	(37.29)
60	1800	364T	93	87	(44.74)
75	1800	365T	93	87	(55.93)
100	1800	405T	94	86	(74.57)
125	1800	444T	94	87	(93.21)
150	1800	445T	94	88	(111.85)
200	1800	447T	95	87	(149.14)
1-1/2	3600	143T	82	85	(1.12)
2	3600	145T	82	87	(1.50)
3	3600	182T	82	87	(2.24)
5	3600	184T	85	88	(3.73)
7-1/2	3600	213T	86	86	(5.60)
10	3600	215T	86	86	(7.46)
15	3600	254T	88	91	(11.19)
20	3600	256T	89	89	(14.91)
25	3600	284T	90	92	(18.64)
30	3600	286T	91	92	(22.37)
40	3600	324T	91	91	(29.83)

** SAFETY PAYS **

Modular Design System				Renovate Commissary for RSC Headquarters Fort Devens, MA	
50	3600	326T	90	92	(37.29)
60	3600	364T	91	93	(44.74)
75	3600	365T	91	91	(55.93)
100	3600	405T	92	92	(74.57)

END OF SECTION 15170

SECTION 15190

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION (NOT APPLICABLE)

1.3 RELATED SECTIONS

A. Section 09900 - Painting: Identification painting.

1.4 CODES AND STANDARDS (Latest Edition or Revision)

A. ASME/ANSI A13.1 - Scheme for the Identification of Piping Systems.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300 and 15010.

B. Submit list of wording, symbols, letter size, letter style and color coding required for each identification material and device.

C. Valve Schedule: Submit valve schedules for each piping system. Reproduce on Standard size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Furnish extra copies (in addition to mounted copies) for Maintenance Manuals as specified in Division 1.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of tagged valves.

1.7 QUALIFICATIONS

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identifying devices.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices after completion of covering and painting where devices are applied to surfaces. Install identifying devices prior to painting where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Acceptable Manufacturers:
1. Seton Co.
2. Brady USA, Inc.
3. Almetek Industries, Inc.

B. Description: Laminated three-layer plastic with engraved white letters on dark contrasting background color.

2.2 TAGS

A. Acceptable Manufacturers:

1. Seton Co.
2. Brady USA, Inc.
3. Almetek Industries, Inc.

B. Metal Tags: Aluminum with 1/4" (6 mm) (minimum) stamped letters; tag size minimum 1-1/2 inch (38 mm) diameter with smooth edges.

B. Chart: Typewritten letter size list in anodized aluminum frame.

2.3 PIPE MARKERS

A. Acceptable Manufacturers:

1. Seton Co.
2. Brady USA, Inc.
3. Almetek Industries, Inc.

B. Color: Conform to ASME/ANSI A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (152 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

2.4 CEILING TACKS

A. Acceptable Manufacturers:

1. Seton Co.
2. Brady USA, Inc.
3. Almetek Industries, Inc.

B. Description: Steel with 3/4 inch (19 mm) diameter color coded head.

C. Color code as follows:

1. Yellow - HVAC equipment
2. Red - Fire dampers/smoke dampers
3. Green - Plumbing valves
4. Blue - Heating/cooling valves

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers completely around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches (152 to 203 mm) below finished grade, directly above buried pipe.

F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify thermostats relating to terminal boxes or valves with nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify air terminal units and radiator valves with numbered tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch (19 mm)

diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6.1 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. Identify ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

N. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 LABELING AND IDENTIFYING

A. Plastic markers with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.

1. Fasten markers on pipes smaller than 6 inches (152 mm) by one of following methods:

a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
b. Adhesive lap joint in pipe marker overlap.
c. Laminated or bonded application of pipe marker to pipe (or insulation).
d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4-inch (19 mm) wide, lapped 1-1/2 inches (38 mm) minimum at both ends of pipe marker, and covering full circumference of pipe.

2. Fasten markers on pipes 6 inches (152 mm) and larger by one of following methods:

a. Laminated or bonded application of pipe marker to pipe (or insulation).
b. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 inches (38 mm) wide, lapped 3 inches (76 mm) minimum at both ends of pipe marker, and covering full circumference of pipe.

c. Strapped to pipe (or insulation) with manufacturer's standard stainless steel bands.

B. Locate pipe markers and color bands as follows wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near each valve and control device.
2. Near each branch connection, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near penetrations through walls, floors, ceilings, or enter non-accessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Space at a maximum of 50-feet (15.2 m)intervals along each run. Reduce intervals to 25 feet (7.6 m) in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

C. Valve Tags: Install valve tag on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shut-off valves, faucets, convenience and lawn-watering hose bibbs, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.

1. Install mounted valve schedule in each major equipment room.

D. Equipment Signs: Install engraved plastic laminate signs or equipment markers on or near each major item of mechanical equipment.

1. Provide signs for following general categories of equipment:

a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
b. Meters, gages, thermometers, and similar units.
c. Fuel-burning units including boilers, furnaces,

and heaters.

d. Pumps, compressors, chillers, condensers, and similar motor-driven units.
e. Heat exchangers, coils, evaporators, cooling towers, and similar equipment.
f. Fans, blowers, primary balancing dampers, and mixing boxes.
g. Packaged HVAC central-station and zone-type units.
h. Tanks and pressure vessels.
i. Strainers, filters, humidifiers, water treatment systems, and similar equipment.

2. Lettering Size: Minimum 1/4 inch (6 mm) for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2 inch (13 mm) for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

3. Terms on Signs: In addition to name of identified unit distinguish between multiple units, indicate operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

E. Plasticized Tags: Install within concealed space to reduce amount of text in exposed sign (outside concealment), where equipment to be identified is concealed above acoustical ceiling or similar concealment.

1. Identify operational valves and similar minor equipment items located in unoccupied spaces (including machine rooms) by installing plasticized tags.

F. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers and arrows showing duct system service and direction of flow.

1. Location: In each space where ducts are exposed or concealed by removable ceiling system. Locate signs near points where ducts enter into concealed space and at maximum intervals of 50 feet (15.2 m).

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices which have become visually blocked by work of this Division or other Divisions.

B. Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 15190

SECTION 15245

VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fiberglass Pads and Shapes.

B. Neoprene Pads.

C. Vibration Isolation Springs.

D. Pad-Type Isolators.

E. Plate-Type Isolators.

F. Double-Plate-Type Isolators.

G. Threaded Double-Plate-Type Isolators.

H. All-Directional Anchors.

I. Neoprene Mountings.

J. Spring Isolators, Free-Standing.

K. Spring Isolators, Housed.

L. Spring Isolators, Vertically-Restrained.

M. Equipment Rails.

N. Fabricated Equipment Bases.

O. Inertia Base Frames.

P. Roof-Curb Isolators.

Q. Isolation Hangers.

R. Riser Isolators.

S. Seismic Snubbers.

T. Thrust Restraints.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03300 - Concrete: Supply of concrete for placement by this Section.

1.3 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete.

B. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

C. Section 15121 - Piping Expansion Compensation.

D. Section 15140 - Supports and Anchors.

E. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.4 PERFORMANCE REQUIREMENTS

A. Extent of vibration control work required by this section is indicated on drawings and schedules, and/or specified in other Division-15 sections.

B. Provide vibration isolation on motor driven equipment over 0.5 HP (0.35 kW), plus connected piping and ductwork.

C. Provide minimum static deflection of isolators for equipment as indicated.

1. Basement, Under 20 hp (15 kw)
   a. Under 400 rpm: 1 1/2 inch
   b. 400 - 600 rpm: 1 inch (25 mm)
   c. 600 - 800 rpm: 0.5 inch (13 mm)
   d. 800 - 900 rpm: 0.2 inch (5 mm)
   e. 1100 - 1500 rpm: 0.14 inch (4 mm)
   f. Over 1500 rpm: 0.1 inch (3 mm)

2. Basement, Over 20 hp (15 kw)

   a. Under 400 rpm: 3 inch
   b. 400 - 600 rpm: 2 inch (51 mm)
   c. 600 - 800 rpm: 1 inch (25 mm)
   d. 800 - 900 rpm: 0.5 inch (13 mm)
   e. 1100 - 1500 rpm: 0.2 inch (5 mm)
   f. Over 1500 rpm: 0.15 inch (4 mm)

3. Upper Floors, Normal

    a. Under 400 rpm: 4 inch
    b. 400 - 600 rpm: 3.5 inch (89 mm)
    c. 600 - 800 rpm: 2 inch (51 mm)
    d. 800 - 900 rpm: 1 inch (25 mm)
    e. 1100 - 1500 rpm: 0.5 inch (13 mm)
    f. Over 1500 rpm: 0.2 inch (5 mm)

4. Upper Floors, Critical

    a. Under 400 rpm: 5 inch
    b. 400 - 600 rpm: 4 inch
    c. 600 - 800 rpm: 3.5 inch (89 mm)
    d. 800 - 900 rpm: 2 inch (51 mm)
    e. 1100 - 1500 rpm: 1 inch (25 mm)
    f. Over 1500 rpm: 0.5 inch (13 mm)

D. Upper floor locations shall be considered critical unless otherwise indicated.

E. Use concrete inertia bases for fans having static pressure in excess of 3.5 inch WC (0.87 kPA) or motors in excess of 40 HP (30 kW), and on base mounted pumps over 10 HP (7.5 kW).

1.5 QUALIFICATIONS

A. Manufacturers:

1. Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

2. Except as otherwise indicated, obtain vibration control products from single manufacturer.

3. Engage manufacturer to provide technical supervision of installation of vibration control products.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300 and 15010.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weights, required

clearances, and method of assembly of components. Detail bases, and show location of equipment anchoring points, coordinated with equipment manufacturer's shop drawings.

C. Product Data: Submit manufacturer's technical product data and installation instructions for each type of vibration control product. Submit schedule showing size, type, deflection, and location for each product furnished.

D. Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

E. Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

F. Maintenance Data: Submit maintenance data for each type of vibration control product. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements or Division 1.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01300 and 15010.

B. Record actual locations of hangers including attachment points.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Mason Industries, Inc.

B. Peabody Noise Control, Inc.

C. Vibration Eliminator Co., Inc.

D. Vibration Mountings and Controls, Inc.

2.2 INERTIA BASES, FRAMES AND RAILS

A. Equipment Rails

1. Where rails or beams are indicated for use with isolator units to support equipment, provide steel

beams complying with ASTM A36, with minimum depth of 6" (152mm) or 0.10 x span of beam between isolators (whichever is greater). Provide welded bracket at each end of beams, and anchor each end to spring isolator unit. Provide bolt holes in beams matching anchor bolt holes in equipment. Provide beams of section modulus indicated or, if not indicated, selected for normal-weight equipment loading to limit static load stress to 16,000 psi (110,320 kpa).

B. Fabricated Equipment Bases:

1. Where supplementary bases are indicated for use with isolator units to support equipment (base not integral with equipment), provide welded rectangular unit, fabricated of structural steel shapes, plates and bars complying with ASTM A36, as shown. Provide welded support brackets at points indicated, and anchor base to spring isolator units. Except as otherwise indicated arrange brackets to result in lowest possible mounting height for equipment, but provide minimum of 1" (25mm). Provide bolt holes in base matching anchor bolt holes in equipment.

2. Where indicated, provide for auxiliary motor slide base under motor or motor slide rails for adjusting belt tension. Design primary base for bolting of rails or slide base in position.

3. Where sizes of base framing members are not indicated, fabricate base with depth of structure not less than 0.10 x longest span of base, rigidly braced to support equipment without deflections or distortions which would be detrimental to equipment or equipment performance.

C. Inertia Base Frames:

1. Where inertia bases are indicated for use with isolation units to support equipment, provide rectangular structural beam channel, or complete sheet metal box concrete forms for floating foundations, with materials complying with ASTM A36. Frame unit as shown or, if not shown, with minimum depth of 0.08 x longest dimension of base, but not less than 6" (153 mm) deep. Size frame as

shown or, if not shown, so that weight of frame plus concrete fill will be greater than operating weight of equipment supported. Provide steel reinforcing both ways with both ends of reinforcing butt welded to base framing.

2. Provide welded support brackets at points indicated, and anchor base frame to spring isolator units.

3. Provide anchor bolts, located as required for equipment anchorage and supported for casting of concrete. Locate bolts as indicated.

4. Provide adjustable bolts in pipe sleeves; for minimum of 1/2" (13mm) adjustment around anchor bolts.

2.3 PAD AND PLATE TYPE ISOLATORS

A. Fiberglass pads and Shapes:

1. Glass fiber of not more than 0.18 mil (0.005 mm) diameter, produced by multiple-flame attenuation process, molded with manufacturer's standard fillers and binders through 10 compression cycles at 3 times rated load bearing capacity, to achieve natural frequency of not more than 12 Hertz, in thicknesses and shapes required for use in vibration isolation units.

B. Neoprene Pads:

1. Oil-resistant neoprene sheets, of manufacturer's standard hardness and cross-ribbed or waffled pattern.

C. Pad-Type Isolators:

1. Except as otherwise indicated, provide manufacturer's standard pad-type isolation unit, fiberglass pads or shapes, or neoprene pads.

D. Plate-Type Isolators:

1. Laminate pad-type isolator to steel plate.

E. Double-Plate-Type Isolators:

1. Cement pad-type isolator to either side of 16-ga (1.6 mm) shim and cement assembly to load distribution steel plate.

2. Where required for anchorage of equipment, include threaded anchor bolt secured to plate and extending through unit, distance sufficient for anchorage of equipment as indicated.

3. Include 2 holes in plate for bolting unit to substrate.

F. Threaded Double-Plate-Type Isolators:

1. Provide double-plate-type isolator, with threaded connection centered in one plate and oversized hole in other plate.

2. Except as otherwise indicated, include threaded insert extending through entire thickness of unit.

3. Include 2 bolts in plate opposite threaded plate, for bolting unit to substrate.

G. All-Directional Anchors:

1. Provide all-directional acoustical pipe anchor consisting of telescopic arrangement of 2 sizes of steel tubing separated by minimum 1/2" (13 mm) thickness of heavy-duty neoprene and duck, or neoprene isolation material. Provide vertical restraints by similar material arranged to prevent vertical travel in either direction. design for maximum 500 psi (3459 kpa) load on isolation materials, and provide for equal resistance in any direction. Equip anchor with threaded hole on top and 2 holes in base plate for bolting down; or provide welding provisions top and bottom, if indicated.

H. Neoprene Mountings:

1. Provide neoprene mountings consisting of neoprene element bonded between 2 steel plates that are neoprene-covered to prevent corrosion. Provide minimum rated deflection of 0.35" (9 mm). Provide threaded hole in upper plate and 2 holes in base plate for securing to equipment and to substrate.

2.4 SPRING TYPE ISOLATORS

A. Vibration Isolation Springs:

1. Wound-steel compression springs, of high-strength spring alloy steel; with spring diameter not less than 0.8 of compressed height of spring at rated loads. Provide minimum additional travel to solid, equal to 50% of rated deflection. Provide spring wire with elastic limit stress exceeding stress at solid deflection.

B. Spring Isolators, Free-Standing:

1. Except as otherwise indicated, provide vibration isolation spring between top and bottom loading plates, and with pad-type isolator bonded to bottom of bottom loading plate. Include studs or cups to ensure centering of spring on plates. Include leveling bolt with lock nuts and washers, centered in top plate, arranged for leveling and anchoring supported equipment as indicated.

2. Include holes in bottom plate for bolting unit to substrate as indicated.

C. Spring Isolators, Housed:

1. Except as otherwise indicated, provide vibration isolation spring between telescoping steel housings with top and bottom loading plates, and with pad-type isolator bonded to bottom of loading plate. Include resilient inserts to separate and guide telescoping housings.

2. Equip top loading plate with equipment anchorages as indicated or as required for support and attachment.

3. Include pad-type isolator bonded to top of top loading plate, except on units with leveling bolts.

4. Include holes in bottom plate for bolting unit to substrate.

D. Spring Isolators, Vertically-Restrained:

1. Provide spring isolators in housing that includes

vertical limit stops. Design housing to act as blocking during erection, and with installed height and operating height being equal. Maintain 1/2" (13 mm) minimum clearance around restraining bolts, and between housing and springs. Design so limit stops are out of contact during normal operation.

E. Isolation Hangers:

1. Hanger units formed with brackets and including manufacturer's standard compression isolators of type indicated. Design brackets for 3 times rated loading of units. Fabricate units to accept misalignment of 15 deg. (0.26 rad) in any direction before contacting hanger box, and for use with either rod or strap type members, and including acoustical washers to prevent metal-to-metal contacts.

2. Provide vibration isolation spring with cap in lower part of hanger and rubber hanger element in top, securely retained in unit.

3. Provide hangers, precompressed to rated load to limit deflection during installation. Design so hanger may be released after full load is applied.

F. Riser Isolators:

1. Suspend risers from, or support risers by, spring hangers or spring isolators. Wherever possible, anchor risers at central point with resilient anchors. Provide hanger or mounting deflection of 0.75" (19 mm) except in those expansion locations where additional deflection is required to limit deflection or load changes to $\pm$ 25% of initial deflection. Provide sliding guides held in position by resilient anchors, located between anchor points and end of piping, spaced as indicated.

G. Spring Isolators, Earthquake-Restrained:

1. Provide spring isolator assembly which will resist horizontal and vertical forces in accordance with applicable regional seismic codes.

2.5 ROOF CURB ISOLATORS

A. Fabricated frame units sized to match roof curbs formed with isolation springs between extruded aluminum upper and lower sections, which are shaped and positioned to prevent metal-to-metal contact. Provide continuous airtight and waterproof seal between upper and lower extrusions. Include provisions for anchorage of frame unit to roof curb, and for anchorage of equipment to unit.

2.6 SEISMIC SNUBBERS AND THRUST RESTRAINTS

A. Seismic Snubbers:

1. Provide seismic snubbers, separate from spring isolators, for attachment to equipment base, designed to provide seismic restraint in all modes in accordance with applicable regional seismic codes. Provide snubbers designed to have no contact during normal operation, and have minimum clearances of 1/4" (6 mm) in all directions.

B. Thrust Restraints:

1. Provide horizontal thrust restraints consisting of spring element in series with neoprene pad. Select spring deflection same as for equipment loading. Design so thrust restraints can be pre-set and adjusted in field. Attach horizontal restraints at centerline of thrust and symmetrically on either side of unit.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which vibration control units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PERFORMANCE OF ISOLATORS

A. General: Comply with minimum static deflections recommended by ASHRAE, for selection and application of vibration isolation materials and units as indicated.

B. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

3.3 APPLICATIONS

A. General:

1. Except as otherwise indicated, select vibration control products in accordance with the Latest Edition of the ASHRAE Handbook, HVAC Applications Volume, under the Chapter entitled "Sound and Vibration Control", Table 27. Where more than one type of product is offered, selection is Installer's option.

B. Piping:

1. For piping connected to equipment mounted on vibration control products, install isolation hangers as indicated, and for first 3 points of support for pipe sizes 4" (102 mm) and less, for first 4 points of support for pipe sizes 5" (127 mm) through 8" (203 mm), and for first 6 points of support for pipe sizes 10" (254 mm) and over.

3.4 INSTALLATION

A. General:

1. Except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration control materials and units. Adjust to ensure that units have equal deflection, do not bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary support during installation.

B. Install units between substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.

C. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where substrate is not level.

D. Install inertia base frames on isolator units as indicated, so that minimum of 1" (25 mm) clearance below base will result when frame is filled with concrete and supported equipment has been installed and loaded for operation.

E. For air handling equipment, install thrust restraints as indicated, and also wherever thrust exceeds 10% of equipment weight.

F. Locate isolation hangers as near overhead support structure as possible.

G. Weld riser isolator units in place as required to prevent displacement from loading and operations.

H. Bases:
   1. Set steel bases for 1-inch (25 mm) clearance between housekeeping pad and base.
   2. Set concrete inertia bases for 2 inch (51 mm) clearance between housekeeping pad and base.
   3. Adjust equipment level.

I. Install spring hangers without binding.

J. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

K. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

L. Support piping connections to isolated equipment resiliently as follows:
   1. Up to 4 Inch (102 mm) Diameter: First three points of support.
   2. 5 to 8 Inch (127 to 203 mm) Diameter: First four points of support.
   3. 10 inch (254 mm) Diameter and Over: First six points of support.
   4. Select three hangers closest to vibration source for minimum 1.0 inch (25 mm) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch (25 mm) static deflection or 1/2 static deflection of isolated equipment.

M. Connect wiring to isolated equipment with flexible hanging loop.

N. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch (1.5 mm) maximum clearance. Other snubbers shall have clearance between 0.15 inch (4 mm) and 0.25 inch (6 mm).

3.5 ADJUSTING AND CLEANING

A. Upon completion of vibration control work, prepare report showing measured equipment deflections for each major item of equipment as indicated.

B. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possible short-circuit unit isolation.

3.6 PIPE ISOLATION SCHEDULE

Pipe Size Inch (mm)	Isolated Distance from Equipment
1 (25)	120 diameters (3.0 m)
2 (51)	90 diameters (4.6 m)
3 (76)	80 diameters (6.1 m)
4 (102)	75 diameters (7.6 m)
6 (152)	60 diameters (9.1 m)
8 (203)	60 diameters (12.2 m)
10 (254)	54 diameters (13.7 m)
12 (305)	50 diameters (15.2 m)
16 (406)	45 diameters (18.3 m)
24 (610)	38 diameters (23.2 m)

END OF SECTION 15245

SECTION 15260

PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15410 - Plumbing Piping: Placement of hangers and hanger inserts.

B. Section 15510 - Hydronic Piping: Placement of hangers and hanger inserts.

1.3 RELATED SECTIONS

A. Section 09900 - Painting: Painting insulation jacket.

B. Section 15190 - Mechanical Identification.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C195 - Mineral Fiber Thermal Insulation Cement.

D. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

E. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

F. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

G. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.

H. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

I. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.

J. ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.

K. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

L. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

M. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

N. ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).

O. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

P. ASTM E84 - Surface Burning Characteristics of Building Materials.

Q. ASTM E96 - Water Vapor Transmission of Materials.

R. NFPA 255 - Surface Burning Characteristics of Building Materials.

S. UL 723 - Surface Burning Characteristics of Building Materials.

T. ASHRAE 90A - Energy Conservation in New Building Design.

U. ASTM A 167 - Specification for Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet & Strip.

V. ASTM C 553 - Specification for Mineral Fiber Blanket & Felt Insulation.

W. ASTM C 612 - Specification for Mineral Fiber Block &

Board Thermal Insulation.

X. ASTM D 579 - Specification for Greige Woven Glass Fabrics.

Y. NFPA 90A - Air Conditioning & Ventilating Systems.

Z. NFPA 90B - Warm Air Heating & Air Conditioning Systems.

AA. NFPA 96 - Removal of Smoke & Grease-Laden Vapors from Commercial Cooking Equipment.

AB. NFPA 220 - Standard on Types of Building Construction.

1.5 SUBMITTALS:

A. Submit under provisions of Sections 01300 and 15010.

B. Product Data: Provide product description, list of materials, k-value, and thickness for each service, and locations.

C. Material Certificates: Submit material certificates, signed by the manufacturers, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.

D. Test Reports: Submit material test reports prepared by a qualified independent testing laboratory. Certify that insulation meets specified requirements.

E. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.6 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation facings, cements, and adhesives, when tested according to ASTM E84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

B. Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than

150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

1.7 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Sections 01300 and 15010.

B. Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.10 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of piping systems.

B. Schedule insulation application after installation and testing of heat trace tape.

PART 2 - PRODUCTS

2.1 GLASS FIBER

A. Acceptable Manufacturers:
1. Owens-Corning
2. Certainteed Corp.
3. Manville/Schuller
4. Knauf Fiber Glass

B. Insulation: Shall meet requirements of ASTM C547, and shall be rigid molded and noncombustible.

1. K (BTU.IN/H.SF.F) value : ASTM C335, 0.24 at 75 degrees F (0.035 (W/M.K) at 24 degrees C).
2. Minimum Service Temperature: -20 degrees F (-28.9 degrees C).
3. Maximum Service Temperature: 450 degrees F (232 degrees C).
4. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket

1. Jacket shall meet requirements of ASTM C921. White kraft paper shall be reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
3. Secure with self sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

D. Tie Wire: 18 gage (1.2 mm) stainless steel with twisted ends on maximum 12 inch (305 mm) centers.

E. Vapor Barrier Lap Adhesive

1. Acceptable Manufacturers:

a. Halstead Industries, Inc.
b. Hardcast, Inc.
c. Loctite Corp.

2. Adhesive shall be waterproof, fire-retardant type, and shall be compatible with insulation used.

F. Insulating Cement/Mastic

1. Cement/Mastic shall meet requirements of ASTM C195, with hydraulic setting on mineral wool.

G. Fibrous Glass Fabric

1. Cloth shall be untreated; 9 oz/sq yd (305 g/sq m) weight.
2. Blanket shall be 1.0 lb/cu ft (16 kg/cu m) density.

H. Indoor Vapor Barrier Finish

1. Vinyl emulsion type acrylic shall be compatible with insulation used, and shall have white color.

I. Outdoor Vapor Barrier Mastic

1. Mastic shall be vinyl emulsion type acrylic, compatible with insulation used, and shall have white color.

J. Insulating Cement

1. Cement shall meet requirements of ASTM C449.

2.2 CELLULAR GLASS

A. Acceptable Manufacturers:

1. Pittsburgh Corning Corp.

B. Insulation shall meet requirements of ASTM C552.

1. K (BTU.IN/H.SF.F) value: 0.40 at 75 degrees F (0.058 (W/M.K) at 24 degrees C).
2. Maximum Water Vapor Transmission: 0.1 perm. Inches.

2.3 HYDROUS CALCIUM SILICATE

A. Acceptable Manufacturers:

1. Owens-Corning
2. Manville/Schuller

B. Insulation shall meet requirements of ASTM C533; and shall be rigid molded white and asbestos free.

1. K (BTU.IN/H.SF.F) value: ASTM C177 and C518; 0.44 at 300 degrees F (0.060 (W/M.K) at 147 degrees C).
2. Maximum Service Temperature: 1500 degrees F (815 degrees C).
3. Density: 13 lb/cu ft (208 kg/cu m).

C. Tie Wire shall be 18 gage (1.2 mm) stainless steel with twisted ends on maximum 12 inch (305 mm) centers.

D. Insulating Cement

1. Cement shall meet requirements of ASTM C449.

E. Insulation shall be used for the following applications:

1. Kitchen Exhaust Hood Grease Ducts.

2.4 CELLULAR FOAM

A. Acceptable Manufacturers:

1. Armstrong World Industries, Inc.
2. Halstead Industrial Products
3. Rubatex Corp.

B. Insulation shall meet requirements of ASTM C534, and shall be flexible, cellular elastomeric, molded or sheet.

1. K (BTU.IN/H.SF.F) Value: ASTM C177 or C518; 0.27 at 75 degrees F (0.04 (W/m.K) at 24 degrees C).
2. Minimum Service Temperature: -40 degrees F (-40 degrees C).
3. Maximum Service Temperature: 220 degrees F (104 degrees C).
4. Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
5. Moisture Vapor Transmission: ASTM E96; 0.20 perm inches.
6. Maximum Flame Spread: ASTM E84; 25.
7. Maximum Smoke Developed: ASTM E84; 50.
8. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive

1. Adhesive shall be air dried, contact type, and shall be compatible with insulation used.

2.5 JACKETS

A. PVC Plastic

1. Jacket shall meet requirements of ASTM C921, and shall have one piece molded type fitting covers and sheet material, with off white color.

a. Minimum Service Temperature: -40 degrees F (-40 degrees C).
b. Maximum Service Temperature: 150 degrees F (66 degrees C).
c. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
d. Maximum Flame Spread: ASTM E84; 25.
e. Maximum Smoke Developed: ASTM E84; 50.
f. Thickness: 15 mil (0.38 mm).
g. Connections: Pressure sensitive color matching vinyl tape.

2. Covering Adhesive Mastic

a. Mastic shall be compatible with insulation used.

B. ABS Plastic

1. Jacket shall have one piece molded type fitting covers and sheet material, and shall have off white color.

a. Minimum Service Temperature: -40 degrees F (-40 degrees C).
b. Maximum Service Temperature of 180 degrees F (82 degrees C).
c. Moisture Vapor Transmission: ASTM E96; 0.012 perm inches.
d. Thickness: 30 mil (0.76 mm).
e. Connections: Brush on welding adhesive.

C. Canvas Jacket shall be UL listed.

1. Fabric shall meet requirements of ASTM C921, and shall be 6 oz/sq yd (220 g/sq m), plain weave cotton, treated with dilute fire retardant lagging adhesive.

2. Lagging Adhesive

a. Adhesive shall be waterproof, fire-retardant type, and shall be compatible with insulation used.

D. Aluminum Jacket shall meet requirements of ASTM B209.

1. Thickness: 0.025 inch (0.064 mm) sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch (51 mm) laps.
4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

E. Stainless Steel Jacket shall be Type 304 stainless steel.

1. Thickness: 0.016 inch (0.40 mm).
2. Finish: Corrugated.
3. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 PREPARATION

A. Surface Preparation:

1. Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mixing:

1. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless steel surfaces with demineralized water.
2. Follow cement manufacturer's printed instructions for mixing and portions.

3.3 INSTALLATION

A. Refer to schedules at the end of this Section for

materials, forms, jackets, and thicknesses required for each mechanical systems. Install materials in accordance with manufacturer's instructions.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation of jacket in either the wet or dry state.

C. Install vapor barriers on insulated equipment having surface operating temperatures below 60 deg F (16 deg C).

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier. On exposed piping, locate insulation, and cover seams in least visible locations.

G. Finish and seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric cellular foam insulation, taper ends at 45 degree (0.79 Rad) angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular foam insulation square and seal with adhesive.

I. Apply adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment.

1. Flexible connectors.
2. Vibration control devices.
3. Fire protection piping systems.
4. Sanitary drainage and vent piping.
5. Below grade piping.
6. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
7. Piping specialties including air chambers, unions, strainers, check valves, and flow regulators.

L. Tightly butt longitudinal seams and end joints. Bond with adhesive.

M. Stagger joints on double layers of insulation.

N. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

O. Apply insulation with a minimum number of joints.

P. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Cover circumferential joints with butt strips, at least 3-inches (76mm)wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches (102mm) on center.
3. Longitudinal Seams: Overlap seams at least 1-1/2 inches (38mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (102mm) on center. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F (2 deg C).
4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches (51 mm) in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

Q. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches (51mm) below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.

R. Exterior Wall Penetrations: For penetrations of below grade exterior walls, extend metal jacket for exterior insulation through penetration to a point 2 inches (51 mm) from interior surface of wall inside the building. Seal ends of metal jacket with vapor barrier coating. Secure metal jacket ends with metal band. At point where insulation metal jacket contacts mechanical sleeve seal, insert cellular glass preformed pipe insulation to allow sleeve seal tightening against metal jacket. Tighten and seal sleeve to jacket to form a watertight seal.

S. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches (51 mm) from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section "Joint Sealants."

T. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Division 7 for firestopping and fire-resistant joint sealers.

U. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.

V. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.

1. Use same material and thickness as adjacent pipe insulation.
2. Overlap nesting insulation by 2 inches (51mm) or 1-pipe diameter, which ever is greater.
3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.

4. Insulate elbows and tees smaller than 3-inches(76mm) pipe size with premolded insulation.
5. Insulate elbows and tees 3 inches (76mm) and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.
6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.

W. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified in Division 15 Section "Supports and Anchors." For cold surface piping, extend insulation on anchor legs a minimum of 12 inches (305mm) and taper and seal insulation ends.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

X. Insulated cold pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory applied or field applied.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
3. Finish with glass cloth and vapor barrier adhesive.
4. PVC fitting covers may be used.
5. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
6. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

Y. For insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
3. Finish with glass cloth and adhesive.
4. PVC fitting covers may be used.

3.4 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.

B. Seal exposed ends with lagging adhesive.

C. Seal seams and joints with vapor barrier compound.

3.5 CELLULAR GLASS PIPE INSULATION INSTALLATION

A. Cellular Glass Insulation:

1. Join sections of cellular glass insulation with vapor barrier compound. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.

2. Multiple Layer Installations: Stagger joints of multilayer installations. Secure inner layer with glass fiber reinforced tape. Secure outer layers with 2 metal bands for each insulation section.

3. Finishing: Apply metal jacket over manufacturer's recommended vapor barrier mastic.

3.6 CELLULAR FOAM INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.

B. Valves, Fittings, and Flanges:

1. Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
2. Miter cut materials to cover soldered elbows and tees.
3. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

C. Finishing:

1. Apply a skim coat of mineral fiber, hydraulic-

setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on 1 layer of glass cloth or glass tape. Overlap edges at least 1 inch (25mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth finish.

D. Metal Jacket:

1. Where indicated, apply metal jacket over finished insulation as specified in this section for installation of metal jackets.

3.7 JACKETS

A. Foil and Paper Jackets (FP):

1. Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch (38mm)laps at longitudinal joints and 3-inch (76mm)wide butt strips at end joints.
2. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

B. Interior Exposed Insulation: Install continuous aluminum jackets.

C. Exterior Exposed Insulation: Install continuous stainless-steel jackets and seal all joints and seams with waterproof sealant.

D. Install metal jacket with 2-inch (51mm) overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel draw bands 12 inches (305mm) on center and at butt joints.

E. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet (3 meters) above finished floor, finish with aluminum jacket.

F. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor

barrier cement. Cover with stainless steel jacket with seams located on bottom side of horizontal piping.

G. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with stainless steel jacket with seams located on bottom side of horizontal piping.

3.8 FINISHES

A. Paint finished insulation as specified in Division 9 Section "Painting."

B. Flexible Elastomeric Cellular Foam Insulation:
1. After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.9 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.10 GLASS FIBER INSULATION SCHEDULE

PIPING SYSTEMS

A. Plumbing Systems

Domestic Hot Water Supply
Domestic Hot Water Recirc
Domestic Cold Water
Plumbing Vents Within 10 Feet
(3 Meters) of the Exterior

B. Heating Systems

Heating Hot Water Supply
Heating Hot Water Return
Steam Piping
Condensate Piping

C. Cooling Systems

Chilled Water Supply

Chilled Water Return
Condenser Water
Cold Condensate Drains
Cooling Coil Condensate Drains
Refrigerant Suction
Refrigerant Hot Gas

D. Other Systems

Humidifier Piping
Piping Exposed to Freezing
with Heat Tracing

3.11 CELLULAR GLASS INSULATION SCHEDULE

PIPING SYSTEMS

A. Plumbing Systems

Domestic Hot Water Supply
Domestic Hot Water Recirc
Domestic Cold Water
Plumbing Vents Within 10 Feet
(3 Meters) of the Exterior

B. Heating Systems

Heating Hot Water Supply
Heating Hot Water Return

C. Cooling Systems

Chilled Water Supply
Chilled Water Return
Condenser Water
Cold Condensate Drains
Cooling Coil Condensate Drains
Refrigerant Suction
Refrigerant Hot Gas

D. Other Systems

Humidifier Piping
Piping Exposed to Freezing
with Heat Tracing

3.12 CELLULAR FOAM INSULATION SCHEDULE

PIPING SYSTEMS

A. Plumbing Systems

Domestic Hot Water Supply
Domestic Hot Water Recirc
Domestic Cold Water
Plumbing Vents Within 10 Feet
(3 Meters) of the Exterior

B. Heating Systems

Heating Hot Water Supply
Heating Hot Water Return

C. Cooling Systems

Chilled Water Supply
Chilled Water Return
Condenser Water
Cold Condensate Drains
Condensate Drains from Cooling Coils
Refrigerant Suction
Refrigerant Hot Gas

D. Other Systems

Humidifier Piping
Piping Exposed to Freezing
with Heat Tracing

3.13 Above Ground Cold Pipeline Insulation Thickness

Pipe Size, Inches (mm)

Service or Range of Temp degrees F (degrees C)		Run-outs* 1/4-1-1/2 (6-38)	1/4-1-1/4 (6-32)	1-1/2 -3 (38-76)	3-1/2 -5 (89-125)	6-10 (152-254)	12-24 (305-610)	26-33 (660-838)
60 to 35	(CF)	1/2"	1	1				
(16 to 2)	(CG)		1-1/2	1-1/2	2	2	2	2
	(GF)		1	1	1-1/2	1-1/2	1-1/2	1-1/2

Modular Design System — Renovate Commissary for RSC Headquarters Fort Devens, MA

34 to 0	(CG)	2-1/2	2-1/2	2-1/2	3	3	3-1/2
(1 to -17)	(GF)	1-1/2	1-1/2	2	2	2-1/2	2-1/2
-1 to -30	(CG)	3	3	3	3-1/2	3-1/2	4
(-18 to -34	{GF)	1-1/2	2	2-1/2	2-1/2	3	3
Domestic	(CF)	1/2"	1/2"	1/2			
Cold Water	(CG)	1	1	1-1/2	1-1/2	1-1/2	
	(MF)	1/2"	1/2"	1/2"	1	1	1

NOTES: (CG) - Cellular Glass
(GF) - Glass Fiber
(CF) - Cellular Foam

* When runouts to terminal units exceed 12 feet (3.7 m),the entire length of runout shall be insulated like the main feed pipe.

3.14 REQUIRED THICKNESS (IN INCHES) OF PIPE INSULATION FOR HANDLING FLUIDS OTHER THAN DOMESTIC HOT WATER TO 250 DEGREES F (121 degrees C).

k = thermal conductivity (average) Btu/hr. sq. ft. degree/in. thickness at a mean temperature of 75 degrees F (29 degrees C).

Thermal conductivity k	Pipe Size, Inches (mm) 2 or > (51 or >)	2-1/2-3 (64-76)	4 (102)	5 to 6 (127-152)	8 (63)	10 (254)	12 (305)
0.25	1.5	1.5	2.0	2.0	2.0	2.0	2.5
0.30	1.5	2.0	2.5	2.5	2.5	2.5	3.0
0.35	2.0	2.5	2.5	2.5	3.5	3.5	3.5
0.40	2.5	3.5	3.5	3.0	4.0	4.0	4.0
0.45	3.0	4.0	4.0	3.5	4.5	4.5	4.5

3.15 REQUIRED THICKNESS (IN INCHES) OF PIPE INSULATION FOR PIPES HANDLING STEAM TO 250 PSIG (1720 kpa) AND FLUIDS OTHER THAN DOMESTIC HOT WATER TO 450 DEGREES F (232 Degrees C)

k = thermal conductivity (average) Btu/hr. sq. ft. degree/in. thickness at a mean temperature of 75 degrees F (29 degrees C).

Thermal conductivity	Pipe Size, Inches (mm) 2or	2-1\2

k	less (51 or >)	to 3 (64-76)	4 (102)	5 (127-152)	8 (203)	10 (254)	12 (305)
0.25	2.0	2.5	2.5	3.5	3.5	3.5	3.5
0.30	2.0	2.5	2.5	3.5	3.5	3.5	3.5
0.35	3.0	3.5	3.5	4.0	4.0	4.0	4.0
0.40	3.5	4.0	4.0	4.5	4.5	4.5	4.5
0.45	4.5	5.0	5.0	5.5	5.5	5.5	5.5

3.16 REQUIRED THICKNESS (IN INCHES) OF PIPE INSULATION FOR PIPES HANDLING DOMESTIC HOT WATER. (GF) - GLASS FIBER, (CG) - CELLULAR GLASS, (CF) - CELLULAR FOAM

		Pipe Size, Inches (mm)						
Range of Service degrees F (degrees C)	Runouts* 1/4 to 1-1/2" (6-38)	2 or less (51 or >)	2-1/2 to 3 (63-76)	4 (102)	5 to 6 (127-152)	8 (203)	10 (254)	12 (305)
61 to 200 (GF)		1.0	1.5	1.5	1.5	1.5	1.5	1.5
(16 to 93) (CG)		1.5	2.5	2.5	2.0	2.0	2.0	2.0
(CF)	1/2	1.0	1.5	1.5	1.5			

* When runouts to terminal units exceed 12 feet, (3.7 m) the entire length of runout shall be insulated like the main feed pipe.

END OF SECTION 15260

SECTION 15280

EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment insulation.

B. Covering.

C. Breeching insulation.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15410 - Plumbing Piping: Placement of hangers and hanger inserts.

B. Section 15510 - Hydronic Piping: Placemnet of handers and hanger inserts.

1.3 RELATED SECTIONS

A. Section 09900 - Painting: Painting insulation covering.

B. Section 15190 - Mechanical Identification.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C195 - Mineral Fiber Thermal Insulation Cement.

D. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

E. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

F. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat

Flow Meter Apparatus.

G. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.

H. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

I. ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.

J. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

K. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

L. ASTM C640 - Corkboard and Cork Pipe Thermal Insulation.

M. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

N. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

O. ASTM E84 - Surface Burning Characteristics of Building Materials.

P. ASTM E96 - Water Vapor Transmission of Materials.

Q. NFPA 255 - Surface Burning Characteristics of Building Materials.

R. UL 723 - Surface Burning Characteristics of Building Materials.

S. ASHRAE 90A - Energy Conservation in New Building Design.

T. ASTM A 167 - Specification for Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet & Strip.

U. ASTM C 547 - Specification for Mineral Fiber Preformed Pipe Insulation.

V. ASTM D 579 - Specification for Greige Woven Glass Fabrics.

W. NFPA 90A - Air Conditioning & Ventilating Systems.

X. NFPA 90B - Warm Air Heating & Air Conditioning Systems.

Y. NFPA 96 - Removal of Smoke & Grease-Laden Vapors from Commercial Cooking Equipment.

Z. NFPA 220 - Standard on Types of Building Construction.

1.5 SUBMITTALS

A. Submit under provisions of Sections 01300 and 15010.

B. Product Data: Provide product description, list of materials, k-value, and thickness for equipment scheduled.

C. Material Certificates: Submit material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.

D. Test Reports: Submit test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

E. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.6 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation facings, cements, and adhesives, when tested according to ASTM E84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

B. Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame

spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

1.7 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01300 and 15010.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.10 SEQUENCING AND SCHEDULING

A. Schedule insulation application testing of equipment.

PART 2 - PRODUCTS

2.1 GLASS FIBER, RIGID

A. Acceptable Manufacturers:
1. Owens-Corning
2. Certainteed Corp.

3. Manville/Schuller
4. Knauf Fiber Glass

B. Insulation shall meet requirements of ASTM C612, and shall be rigid and noncombustible.

1. 'K' (BTU.IN/H.SF.F) value : ASTM C335, 0.24 at 75 degrees F (0.035 (W/m.K) at 24 degrees C).
2. Maximum service temperature: 450 degrees F (232 degrees C).
3. Maximum moisture absorption: 0.1 percent by volume.
4. Density: 1.6 lb/cu ft (26 kg/cu m) density.

C. Vapor Barrier Jacket

1. Jacket shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm. inches.
3. Secure with self sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

D. Facing: 1 inch (25 mm) galvanized steel hexagonal wire mesh stitched on both faces of insulation.

E. Vapor Barrier Lap Adhesive
1. Adhesive shall be waterproof, fire-retardant type, and shall be compatible with insulation used.

F. Insulating Cement/Mastic
1. Cement/mastic shall meet requirements of ASTM C195 with hydraulic setting on mineral wool, and shall be compatible with insulation used.

2.2 CELLULAR GLASS

A. Acceptable Manufacturers:

1. Pittsburg Corning Corp.

B. Insulation shall meet requirements of ASTM C552.

1. 'K' (BTU.IN/H.SF.F) value: 0.35 (w/m.K) at 75 degrees F (0.047 at 24 degrees C).
2. Density: 8.0 lb/cu ft (128 kg/cu m).

2.3 CELLULAR FOAM

A. Acceptable Manufacturers:

1. Armstrong World Industries, Inc.
2. Halstead Industrial Products
3. Rubatex Corp.

B. Insulation shall meet requirements of ASTM C534, and shall be flexible, cellular elastomeric, molded or sheet.

1. 'K' (BTU.IN/H.SF.F) value: ASTM C177 or C518; 0.27 at 75 degrees F (0.04 (W/m.K) at 24 degrees C).
2. Minimum service temperature: -40 degrees F (-40 degrees C).
3. Maximum service temperature: 220 degrees F (104 degrees C).
4. Maximum moisture absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
5. Moisture vapor transmission: ASTM E96; 0.20 perm inches.
6. Maximum flame spread: ASTM E84; 25.
7. Maximum smoke developed: ASTM E84; 50.
8. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive

1. Adhesive shall be air dried, contact type, and shall be compatible with insulation used.

2.4 JACKETS

A. PVC Plastic

1. Jacket shall meet requirements of ASTM C921, and shall be Sheet material, with off white color.

a. Minimum service temperature: -40 degrees F (-40 degrees C).
b. Maximum service temperature: 150 degrees F (66 degrees C).
c. Moisture vapor transmission: ASTM E96; 0.002 perm inches.
d. Maximum flame spread: ASTM E84; 25.
e. Maximum smoke developed: ASTM E84; 50.
f. Thickness: 15 mil (0.38 mm).

g. Connections: Pressure sensitive color matching vinyl tape.

2. Covering Adhesive Mastic

a. Mastic shall be compatible with insulation used.

B. Canvas Jacket shall be UL listed.

1. Fabric: ASTM C921, 6 oz/sq yd (220 g/sq m), plain weave cotton treated with dilute fire retardant lagging adhesive.

2. Lagging Adhesive

a. Adhesive shall be water proof, fire-retardant type, and shall be compatible with insulation used.

C. Aluminum Jacket shall meet requirements of ASTM B209.

1. Thickness: 0.025 inch (0.064 mm) sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch (51 mm) laps.
4. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

D. Stainless Steel Jacket shall be: Type 304 stainless steel.

1. Thickness: 0.016 inch (0.41 mm).
2. Finish: Corrugated.
3. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 PREPARATION

A. Surface Preparation:

1. Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mixing:

1. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless steel surfaces with demineralized water.
2. Follow cement manufacturer's printed instructions for mixing and portions.

3.3 INSTALLATION

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical systems. Install materials in accordance with manufacturer's instructions.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation of jacket in either the wet or dry state.

C. Install vapor barriers on insulated equipment having surface operating temperatures below 60 deg F (16 deg C).

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier. On exposed equipment, locate insulation, and cover seams in least visible locations.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric cellular foam insulation, taper ends at 45 degree (0.79 Rad) angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular foam insulation square

and seal with adhesive.

I. Apply adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment.

1. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
2. Flexible connectors.
3. Vibration control devices.
4. Testing laboratory labels and stamps.
5. Nameplates and data plates.
6. Access panels and doors in air distribution systems.

L. Install board and block materials with a minimum dimension of 12 inches (305 mm) and a maximum dimension of 48 inches (1219 mm).

M. Groove, score, and bevel insulation materials as required to fit as closely as possible to the equipment, and to fit contours of equipment. Stagger end joints. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

N. Insulation Thicknesses Greater than 2 Inches (51 mm): Install insulation in multiple layers with staggered joints.

O. Bevel insulation edges for cylindrical surfaces for tight joint.

P. Secure sections of insulation in place with wire or bands spaced at 9 inches (229 mm) centers, except for flexible elastomeric cellular foam insulation.

Q. Protect exposed corners with corner angles under wires and bands.

R. Manholes, Handholes and Information Plates: Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

S. Removable Insulation: Install insulation on components that require periodic inspecting, cleaning, and repairing for easy removal and replacement without damage to adjacent insulation.

T. Pumps: Where insulation is indicated, fabricate galvanized steel boxes lined with insulation. Fit boxes around pumps and coincide joints in box with the splits in the pump casings. Fabricate joints with outward bolted flanges.

U. Finishing: Except for flexible elastomeric cellular foam insulation, apply 2 coats of vapor barrier compound to a minimum thickness of 1/16 inch (1.6 mm). Install a layer of glass cloth embedded between layers.

V. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

W. Insulated dual temperature equipment or cold equipment containing fluids below ambient temperature:

1. Provide vapor barrier jackets, factory applied or field applied.
2. Finish with glass cloth and vapor barrier adhesive.
3. Insulate entire system.

X. For insulated equipment containing fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
2. Finish with glass cloth and adhesive.
3. For hot equipment containing fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
4. For hot equipment containing fluids over 140 degrees F (60 degrees C), insulate flanges and unions with removable sections and jackets.

Y. Inserts and Shields:

1. Application: equipment 1-1/2 inches (38 mm) diameter or larger.
2. Shields: galvanized steel between hangers and inserts.
3. Insert location: between support shield and

equipment and under the finish jacket.
4. Insert configuration: minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: hydrous calcium silicate insulation.

Z. Install insulation for equipment requiring access for maintenance, repair, or cleaning, in such a manner that it can be easily removed and replaced without damage. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.

3.4 GLASS FIBER EQUIPMENT INSULATION INSTALLATION

A. Secure insulation with anchor pins and speed washers.

B. Space anchors at maximum intervals of 18 inches (457 mm)in both directions and not more than 3 inches (76 mm) from edges and joints.

C. Apply a smoothing coat of insulating and finishing cement to finished insulation.

3.5 CELLULAR GLASS EQUIPMENT INSULATION INSTALLATION

A. Join sections of insulation with vapor barrier compound.

B. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.

C. Secure inner layer of multiple layer installations with glass fiber reinforced tape. Secure outer layers with 2 metal bands for each insulation section.

3.6 CELLULAR FOAM INSULATION INSTALLATION

A. Install sheets of the largest manageable size.

B. Apply full coverage of adhesive to the surfaces of the equipment and to the insulation.

C. Butt insulation joints firmly together and apply adhesive to insulation edges at joints.

3.7 JACKETS

A. Foil and Paper Jackets (FP)

1. Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch (38 mm) laps at longitudinal joints and 3-inch (76 mm) wide butt strips at end joints.
2. Seal openings, punctures, and breaks in vapor barrier jackets, and exposed insulation with vapor barrier compound.

B. Interior Exposed Insulation: Install continuous glass cloth jackets.

C. Install glass cloth jacket directly over insulation. On insulation with a factory applied jacket, install the glass cloth jacket over the factory applied jacket. Install jacket drawn smooth and tight with a 2-inch (51 mm) overlap at joints. Embed glass cloth between (2) 1/16-inch (1.6 mm) thick coats of lagging adhesive. Completely encapsulate the insulation with the jacket, leaving no exposed raw insulation.

D. For equipment in mechanical equipment rooms or in finished spaces, finish with canvas jacket sized for finish painting.

E. For exterior applications, provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with stainless steel jacket with seams located on bottom side of horizontal equipment.

3.8 FINISHES

A. Paint finished insulation as specified in Division 9 Section "Painting."

B. Flexible Elastomeric Cellular Foam Insulation:

1. After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

C. Cover glass fiber, cellular glass, cellular foam insulation with metal mesh and finish with heavy coat of insulating cement.

3.9 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.10 GLASS FIBER, RIGID INSULATION SCHEDULE

EQUIPMENT	THICKNESS Inch (mm)
A. Plumbing Systems	
Domestic Hot Water Storage Tanks	2"(51mm)
B. Heating Systems	
Pump Bodies	2"(51mm)
Air Separators	2"(51mm)
Expansion Tanks	2"(51mm)
Flue Gas Breeching	6"(152mm)
Stacks to Roof	6"(152mm)
C. Cooling Systems	
Pump Bodies	1-1/2" (38mm)
Air Separators	1-1/2" (38mm)
Expansion Tanks	1-1/2" (64mm)
Chiller Cold Surfaces (Not Factory Insulated)	2-1/2" (64mm)
D. Other Systems	
Equipment Exposed to Freezing with Heat Tracing	2-1/2" to 3" (64mm to 76mm)
E. Basis For Insulation Thickness:	
Equipment Handling Media Between 35 deg F & 60 deg F: (2deg C and 15 deg C)	1-1/2" mineral fiber (38mm)
Equipment Handling Media Between 0 deg F & 34 deg F: (-17 deg C and 1 deg C)	2-1/2" mineral fiber (64mm)
Equipment Handling Media Between -30 deg F & -1 deg F: (-35 deg C and -18 deg C)	3-1/2 mineral fiber (89mm)

Equipment Handling Media Between 61 deg F & 250 deg F: (16 deg C and 121 deg C)	2" mineral fiber (51mm)
Equipment Handling Media Between 251 deg F & 400 deg F: (122 deg C and 204 deg C)	3-1/2" mineral fiber (89mm)
Equipment Handling Media Between 401 deg F & 600 deg F: (205 deg C and 316 deg C)	6" mineral fiber (152mm)
Equipment Handling Media Between Above 600 deg F: (316 deg C)	Thickness required to limit exterior surface temperature to 120 deg F (49 deg C)

3.11 CELLULAR GLASS INSULATION SCHEDULE

EQUIPMENT	THICKNESS Inch (mm)
A. Plumbing Systems	
Domestic Hot Water Storage Tanks	2"(51mm)
B. Heating Systems	
Pump Bodies	2"(51mm)
Air Separators	2"(51mm)
Expansion Tanks	2"(51mm)
Flue Gas Breeching	6"(152mm)
Stacks to Roof	6"(152mm)
C. Cooling Systems	
Pump Bodies	2"(51mm)
Air Separators	2"(51mm)
Expansion Tanks	2"(51mm)
Chiller Cold Surfaces (Not Factory Insulated)	3-1/2"(89mm)
D. Other Systems	
Equipment Exposed to Freezing with Heat Tracing	3-1/2" to 4" (89mm to 102mm)

E. Basis For Insulation Thickness:

Equipment Handling Media Between 35 deg F & 60 deg F: (2 deg C and 16 deg C)	2" Cellular Glass (51mm)
Equipment Handling Media Between 0 deg F & 34 deg F: (-17 deg C and 1 deg C)	3-1/2" Cellular Glass (89mm)
Equipment Handling Media Between -30 deg F & -1 deg F: (-35 deg C and -18deg C)	4" Cellular Glass (102mm)
Equipment Handling Media Between 61 deg F & 250 deg F: (16 deg C and 121 deg C)	2" Cellular Glass (51mm)
Equipment Handling Media Between 251 deg F & 400 deg F: (122 deg C and 204 deg C)	3-1/2" Cellular Glass (89mm)
Equipment Handling Media Between 401 deg & 600 deg F: (205 deg C and 316 deg C)	6" Cellular Glass (152mm)
Equipment Handling Media Between Above 600 deg F: (316 deg C)	Thickness required to limit exterior surface temperature to 120 deg F (49 deg C).

3.12 CELLULAR FOAM INSULATION SCHEDULE

EQUIPMENT	THICKNESS Inch (mm)
A. Plumbing Systems	
Domestic Hot Water Storage Tanks	2"(51mm)

B. Heating Systems

Pump Bodies	2"(51mm)
Air Separators	2"(51mm)
Expansion Tanks	2"(51mm)
Hot Thermal Storage Tanks	2"(51mm)
Flue Gas Breeching	6"(152mm)
Stacks to Roof	6"(152mm)

C. Cooling Systems

Pump Bodies	1-1/2"(38mm)
Air Separators	1-1/2"(38mm)
Expansion Tanks	1-1/2"(38mm)
Chiller Cold Surfaces (Not Factory Insulated)	2-1/2"(64mm)

D. Other Systems

Equipment Exposed to Freezing with Heat Tracing	2-1/2" To 3" (64mm to 76mm)

E. Basis For Insulation Thickness:

Equipment Handling Media Between 35 deg F & 60 deg F: (2 deg C and 16 deg C)	1-1/2" Cellular Foam (38mm)
Equipment Handling Media Between 0 deg F & 34 deg F: (-17 deg C and 1 deg C)	2-1/2" Cellular Foam (64mm)
Equipment Handling Media Between -30 deg F & -1 deg F: (-35 deg C and -18deg C)	3" Cellular Foam (89mm)
Equipment Handling Media Between 61 deg F & 250 deg F: (16 deg C and 121 deg C)	2" Cellular Foam (51mm)
Equipment Handling Media Between 251 deg F & 400 deg F: (122 deg C and 204 deg C)	3-1/2" Cellular Foam (89mm)
Equipment Handling Media Between 401 deg F & 600 deg F: (205 deg C and 316 deg C)	6" Cellular Foam (152mm)

Equipment Handling Media Between Above 600 deg F: (316 deg C)	Thickness required to limit exterior surface temperature to 120 deg F (49 deg C).

END OF SECTION 15280

SECTION 15290

DUCTWORK INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ductwork insulation.

B. Insulation jackets.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 07416 - Roofing: Installation and finishing of outdoor insulation jacket under roofing.

1.3 RELATED SECTIONS

A. Section 07416 - Roofing: Finishing outdoor insulation jacket.

B. Section 09900 - Painting: Painting insulation jackets.

C. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

D. Section 15190 - Mechanical Identification.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

D. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

E. ASTM E84 - Surface Burning Characteristics of Building Materials.

F. ASTM E96 - Water Vapor Transmission of Materials.

G. NFPA 255 - Surface Burning Characteristics of Building Materials.

H. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

I. UL 723 - Surface Burning Characteristics of Building Materials.

J. ASHRAE 90A - Energy Conservation in New Building Design.

K. ASTM A 167 - Specification for Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet & Strip.

L. ASTM C 195 - Specification for Mineral Fiber Thermal Insulating Cement.

M. ASTM C 449 - Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating & Finishing Cement.

N. ASTM C 534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet & Tubular Form.

O. ASTM C 921 - Specification for Determining the Properties of Jacketing Materials for Thermal Insulation.

P. NFPA 90A - Air Conditioning & Ventilating Systems.

Q. NFPA 90B - Warm Air Heating & Air Conditioning Systems.

R. NFPA 96 - Removal of Smoke & Grease-Laden Vapors from Commercial Cooking Equipment.

S. NFPA 220 - Standard on Types of Building Construction.

1.5 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Product Data: Provide product description, list of materials, k-value, and thickness for each service, and locations.

B. Material Certificates: Submit material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.

C. Test Reports: Submit material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

D. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.6 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E84, by UL or other testing or inspecting organization acceptable to the authority, having jurisdiction. Label insulation with appropriate markings of testing laboratory.

B. Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

1.7 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01300 and 15010.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.10 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of duct systems.

PART 2 PRODUCTS

2.1 GLASS FIBER, FLEXIBLE

A. Acceptable Manufacturers:

1. Owens-Corning
2. Certainteed Corp.
3. Manville/Schuller
4. Knauf Fiber Glass

B. Insulation shall meet requirements of ASTM C612, and shall be flexible, noncombustible blanket type.

1. 'K' (BTU.IN/H.SF.F) value : ASTM C518, 0.29 at 75 degrees F (0.042 W/m.K) at 24 degrees C).
2. Maximum service temperature: 250 degrees F (121 degrees C).
3. Maximum moisture absorption: 0.20 percent by volume.
4. Density: 0.75 lb/cu ft (12 kg/cu m).

C. Vapor Barrier Jacket

1. Jacket shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.04 perm inches.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape

1. Tape shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire shall be Annealed steel, 16 gage (1.6 mm).

2.2 GLASS FIBER, RIGID

A. Acceptable Manufacturers:

1. Owens-Corning
2. Certainteed Corp.
3. Manville/Schuller

4. Knauf Fiber Glass

B. Insulation shall meet requirements of ASTM C612, and shall be rigid, noncombustible blanket.

1. 'K'(BTU.IN/H.SF.F) value : ASTM C518, 0.29 at 75 degrees F (0.042 (W/m.K) at 24 degrees C).
2. Maximum service temperature: 250 degrees F (121 degrees C).
3. Maximum moisture absorption: 0.20 percent by volume.
4. Density: 0.75 lb/cu ft (12 kg/cu m).

C. Vapor Barrier Jacket

1. Jacket shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.04 perm inches.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape

1. Tape shall be Kraft paper reinforced with glass fiber yarn, and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.3 JACKETS

A. Canvas Jacket shall be UL listed

1. Fabric: 6 oz/sq yd (220 g/sq m), plain weave cotton treated with dilute fire retardant lagging adhesive.

2. Lagging Adhesive
a) Adhesive shall be compatible with insulation used.

B. Aluminum Jacket shall meet requirements of ASTM B209.

1. Thickness: 0.025 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch (51 mm) laps.
4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ductwork has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 PREPARATION

A. Surface Preparation:

1. Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mixing:

1. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless steel surfaces with demineralized water.
2. Follow cement manufacturer's printed instructions for mixing and portions.

3.3 INSTALLATION

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system. Install materials in accordance with manufacturer's instructions.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated ducts and plenums having surface operating temperatures below 60 deg F (16 deg C).

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree (0.79 Rad) angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment.

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
3. Flexible connectors.
4. Vibration control devices.
5. Testing laboratory labels and stamps.
6. Nameplates and data plates
7. Access panels and doors in air distribution systems.

L. Install block and board insulation as follows:

1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches (305 mm) apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.
2. Speed Washers Attachment: secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches (457 mm)apart each way and 3 inches (76 mm)from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.

M. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller Than 24 Inches (610 mm): Bonding adhesive applied in 6-inch-wide transverse strips on 12-inch (305 mm) centers.
2. 24 Inches (610 mm) and Larger: Anchor pins spaced 12 inches (305 mm) apart each way. Apply bonding adhesive to prevent sagging of the insulation.
3. Overlap joints 3 inches (76 mm).
4. Seal joints, breaks and punctures with vapor barrier compound.

N. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

O. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

P. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

3.4 JACKETS

A. Foil and Paper Jackets (FP):

1. Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2 inch (38 mm) laps at longitudinal joints and 3-inch (76 mm)wide butt strips at end joints.
2. Seal openings, punctures, and breaks in vapor barrier jackets, and exposed insulation with vapor barrier compound.

B. Interior Exposed Insulation: Install continuous glass cloth jackets.

C. Install glass cloth jacket directly over insulation. On

insulation with a factory applied jacket, install the glass cloth jacket over the factory applied jacket. Install jacket drawn smooth and tight with a 2-inch (51 mm) overlap at joints. Embed glass cloth between (2) 1/16-inch (1.6 mm) thick coats of lagging adhesive. Completely encapsulate the insulation with the jacket, leaving no exposed raw insulation.

D. For ductwork exposed in mechanical equipment rooms or in finished spaces below 10 feet (3 meters) above finished floor, finish with canvas jacket sized for finish painting.

3.5 FINISHES

A. Paint finished insulation as specified in Division 9 Section "Painting."

B. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.6 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.7 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS Inch (mm)	FINISH
Combustion Air Duct	1-1/2" (38mm)	Canvas Jacket
Exhaust Ducts Within 10 ft (3 m) of Exterior Openings	1-1/2" (38mm)	Canvas Jacket
Exhaust Ducts Exposed to Outdoor Air	1-1/2" (38mm)	Canvas Jacket
Outside Air Intake Ducts	1-1/2" (38mm)	Canvas Jacket
Return Air Ducts & Plenums	2" (51mm)	Liner
Supply Air Plenums	2" (51mm)	Canvas Jacket
Ventilation Equipment Casings	2" (51mm)	Canvas Jacket
Supply Ducts	2" (51mm)	Canvas Jacket
Supply Ducts From Fans	2" (51mm)	Canvas Jacket
to Vertical Ducts in Shafts	2" (51mm)	Canvas Jacket
Supply Ducts in Vertical Shafts	2" (51mm)	Canvas Jacket
Supply ducts After Terminal Boxes	2" (51mm)	Canvas Jacket
Return and Relief Ducts in	1-1/2" (38mm)	Canvas Jacket

Mechanical Rooms		
Ducts Exposed to Outdoors	2" (51mm)	Canvas Jacket

3.8 RIGID GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS Inch (mm)	FINISH
Combustion Air Duct	1-1/2" (38mm)	Canvas Jacket
Exhaust Ducts Within 10 ft (3 m) of Exterior Openings	1-1/2" (38mm)	Canvas Jacket
Exhaust Ducts Exposed to Outdoor Air	1-1/2" (38mm)	Canvas Jacket
Outside Air Intake Ducts	1-1/2" (38mm)	Canvas Jacket
Return Air Ducts and Plenums	2" (51mm)	Canvas Jacket
Supply Air Plenums	2" (51mm)	Canvas Jacket
Ventilation Equipment Casings	2" (51mm)	Canvas Jacket
Supply Ducts	2" (51mm)	Canvas Jacket
Supply Ducts From Fans to Vertical Ducts in Shafts	2" (51mm)	Canvas Jacket
Supply Ducts in Vertical Shafts	2" (51mm)	Canvas Jacket
Supply ducts After Terminal Boxes	2" (51mm)	Canvas Jacket
Return and Relief Ducts in Mechanical Rooms	1-1/2" (38mm)	Canvas Jacket
Ducts Exposed to Outdoors	2" (51mm)	Canvas Jacket

END OF SECTION

SECTION 15330

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990; R 1995) Ferritic Malleable Iron Castings
ASTM A 53	(1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	(1997) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 795	(1996) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM D 3309	(1996a) Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems
ASTM F 442	(1994) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Cast Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy

	Solder Joint Pressure Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws Inch Series
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(1995) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
FM P7825b	(1998) Approval Guide Electrical Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(1996; Errata 13-96-1) Installation of Sprinkler Systems
NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 231C	(1995; TIA 95-1) Rack Storage of Materials
NFPA 291	
NFPA 1963	(1993) Fire Hose Connections

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir	(1998) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Rack sprinkler shall be in accordance with NFPA 231C. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of 0.10 GPM/SF (Light-Hazard), 0.15 GPM/SF (Ordinary Hazard), and 0.20 GPM/SF (Ordinary Hazard, Group 2) over the hydraulically most demanding 3,000 square feet of floor area. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 500 gpm shall be added to the

sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a hydrant flow test per NFPA 291. Water supply shall be presumed available at the point of connection to existing. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping.

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Submittals related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The package will be reviewed by the U.S. Army Engineer District Fire Protection Engineer. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Load Calculations for Sizing Sway Bracing

For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

Sprinkler System Equipment; GA.

Manufacturer's Catalog Data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; GA.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts; FIO.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

SD-04 Drawings

Sprinkler System Shop Drawings; GA.

Detail drawings conforming to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation

views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

As-Built Drawings; FIO.

As-built drawings, no later than 14 working days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after work is completed and shall be on reproducible full-size mylar film.

SD-06 Instructions

Test Procedures; GA.

Proposed test procedures for piping hydrostatic test, testing of alarms, at least 14 days prior to the start of related testing.

SD-07 Schedules

Preliminary Tests; GA.

A schedule of preliminary tests, at least 14 days prior to the proposed start of the tests.

Final Test; GA.

Upon successful completion of tests specified under paragraph PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

SD-08 Statements

Installer Qualifications; GA.

Qualifications of the sprinkler installer.

Submittal Preparer's Qualifications; GA.

The name and documentation of certification of the individual who will prepare the submittals, prior to the submittal of the drawings and hydraulic calculations.

SD-13 Certificates

Contractor's Material & Test Certificates; GA.

Certificates, as specified in NFPA 13, shall be completed and signed by the Contractor's Representative performing required tests for both underground and aboveground piping.

SD-19 Operation and Maintenance Manuals

Sprinkler System; GA.

Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

1.4 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.5 SUBMITTAL PREPARER'S QUALIFICATIONS

The sprinkler system submittals, including as-built drawings, calculations, and shop drawings, shall be prepared by an individual who is a registered professional Fire Protection Engineer licensed in the Commonwealth of Massachusetts, and will bear his/her seal.

1.6 INSTALLER QUALIFICATIONS

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project.

A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.7 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.8 DELIVERY AND STORAGE

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be new standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.1.2 Requirements for Fire Protection Service

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.2 NOT USED

2.3 ABOVEGROUND PIPING SYSTEMS

Aboveground piping shall be steel.

2.3.1 Steel Piping System

2.3.1.1 Steel Pipe

Except as modified herein, steel pipe shall be galvanized as permitted by

NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.3.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.3.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.3.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.3.2 Copper Tube Systems

2.3.2.1 Copper Tube

Copper tube shall conform to ASTM B 88, Types L and M.

2.3.2.2 Copper Fittings

Cast copper alloy pressure fittings shall conform to ASME B16.18 and wrought copper and bronze pressure fittings shall conform to ASME B16.22.

2.3.3 Plastic Pipe Systems

2.3.3.1 Plastic Pipe

Plastic pipe shall be listed in UL Fire Prot Dir for use in wet pipe sprinkler systems and shall conform to requirements as follows:

a. Chlorinated Polyvinyl Chloride (CPVC): ASTM F 442, 175 psi rating.

b. Polybutylene (PB): ASTM D 3309, 175 psirating.

2.3.3.2 Plastic Fittings

Plastic fitting shall be chlorinated polyvinyl chloride (CPVC) or polybutylene (PB) as listed in UL Fire Prot Dir for use in wet pipe sprinkler systems.

2.3.4 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized involved.

2.4 NOT USED

2.5 NOT USED

2.6 NOT USED

2.7 NOT USED

2.8 SPRINKLERS

Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Sprinklers with internal O-rings shall not be used.

2.8.1 Upright Sprinkler

Upright sprinkler shall be brass and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.8.2 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, concealed type with nominal 1/2 inch or 17/32 inch orifice. Pendent sprinklers shall have a white enamel finish.

2.8.3 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 1/2 inchorifice. Sidewall sprinkler shall have a white enamel finish. Sidewall sprinkler shall be the quick-response type.

2.8.4 NOT USED

2.8.5 NOT USED

2.8.6 NOT USED

2.8.7 Corrosion Resistant Sprinkler

Corrosion resistant sprinkler shall be the upright type installed in locations as indicated. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.

2.9 DISINFECTING MATERIALS

2.9.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.9.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.10 ACCESSORIES

2.10.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.10.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.10.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.10.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers as indicated.

2.10.5 Identification Sign

Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.11 FIRE HOSE REEL ASSEMBLY

Assembly shall include nozzle, fire hose, reel, 1-1/2 inch valve, and bracket suitable for wall mounting. The assembly shall be semi-automatic type complete with Underwriters clip which permits controlled one-man operation whereby control valve can be opened, hose unreeled and clip released by pulling on hose. Valve shall be non-rising stem, all bronze, angle type with 1-1/2 inch American National Standard Fire Hose Screw Thread (NH) male outlet in accordance with NFPA 1963. Reel shall be of steel construction with red enamel finish and shall be equipped with 100 feet of 1-1/2 inch rubber lined fire hose. Nozzle shall be of the industrial combination fog-straight stream type with shutoff. Components of the assembly shall be listed in UL Fire Prot Dir.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 231C.

3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be run straight and bear evenly on hangers and supports.

3.2.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection of the piping system shall be provided in accordance with NFPA 13 and Appendix A, with the exception that the "Earthquake Zones"

map of Appendix A shall not apply to this project. Seismic protection shall include flexible couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required in NFPA 13 for protection of piping against damage from earthquakes. Branch lines shall be equipped with sway braces at the end sprinkler head and at intervals not exceeding 30 ft.

3.2.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.2.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.2.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.2.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

3.2.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.2.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.2.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings

will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.2.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07840 FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.2.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.2.10 NOT USED

3.2.11 NOT USED

3.2.12 NOT USED

3.2.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.3 NOT USED

3.4 NOT USED

3.5 ELECTRICAL WORK

All wiring for supervisory and alarm circuits shall be #14 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

3.6 DISINFECTION

After all system components are installed and hydrostatic test are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material

shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system if filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.7 FIELD PAINTING AND FINISHING

Field painting and finishing are specified in Section 09900 PAINTING, GENERAL.

3.8 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.8.1 Underground Piping

3.8.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system.

3.8.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

3.8.2 Aboveground Piping

3.8.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.8.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.8.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.9 FINAL ACCEPTANCE TEST

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

-- End of Section --

SECTION 15332

PREACTION AND DELUGE SPRINKLER SYSTEMS, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. ASTM A 47 - Ferritic Malleable Iron Castings

2. ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

3. ASTM A 135 - Electric-Resistance-Welded Steel Pipe

4. ASTM A 183 - Carbon Steel Track Bolts and Nuts

5. ASTM A 536 - Ductile Iron Castings

6. ASTM A 795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

7. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

8. ASME B16.3 - Malleable Iron Threaded Fittings

9. ASME B16.4 - Cast Iron Threaded Fittings

10. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings

11. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded

12. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges

13. ASME B18.2.1 - Square and Hex Bolts and Screws (Inch Series)

14. ASME B18.2.2 - Square and Hex Nuts (Inch Series)

15. ASSE 1015 - Double Check Backflow Prevention Assembly

16. AWWA-01 - Standard Methods for the Examination of Water and Wastewater

17. AWWA B300 - Hypochlorites

18. AWWA B301 - Liquid Chlorine

19. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

20. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (75 mm through 1200 mm), for Water and Other Liquids

21. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

22. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

23. AWWA M20 - Manual: Water Chlorination Principles and Practices

24. FM P7825 - Approval Guide

25. IEEE C62.41 - Surge Voltages in Low-Voltage AC Power Circuits

26. MSS SP-71 - Cast Iron Swing Check Valves, Flanges and Threaded Ends

27. NFPA 13 - Installation of Sprinkler Systems

28. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances

29. NFPA 70 - National Electrical Code

30. NFPA 72 - National Fire Alarm Code

31. NICET 1014 - Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) automatic Sprinkler System Layout

32. UL-01 - Building Materials Directory

33. UL-04 - Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

A. The system shall consist of an automatic preaction sprinkler system and shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall meet the requirements of

NFPA 13 and NFPA 72. The sprinkler system shall be a single interlocked system that requires the actuation of an alarm initiating device to open the water control (deluge) valve. Pipe sizes which are not indicated on the drawings shall be determined by hydraulic calculations.

1. Hydraulic Design: The system shall be hydraulically designed to discharge a minimum density of.10 gpm per square foot over the hydraulically most demanding 3,000 square feet of floor area. Hydraulic calculations shall be provided in accordance with the Area/Density Method of NFPA 13.

    a) Hose Demand: An allowance for exterior hose streams of 500 gpm shall be added to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

    b) Basis for Calculations: The design of the system shall be based on a hydrant flow test per NFPA 291 of hydrants closet to the point where the water service enters the building. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for new galvanized steel piping, and 100 for existing piping.

2. Sprinkler Spacing: Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13 for ordinary hazard occupancy.

3. Control System: The control system shall meet the requirements of NFPA 72. The control panel shall be listed in UL-04 or FM P7825 for "Releasing Device Service". The control panel and the solenoid valve which activites the water control valves shall be compatible with each other. Compatibility shall be per specific UL listing or FM approval of the control equipment.

    a) Power Supply: The primary operating power shall be provided from two single phase 120 VAC circuits. Transfer from normal to backup power and restoration from backup to normal power shall be fully automatic and not cause a false alarm. Loss of primary power shall not prevent actuation of the respective automatic water control valve upon activation of any alarm initiating device. Backup power shall be provided through use of rechargeable, sealed, lead calcium storage batteries.

b) Circuit Requirements: Alarm initiating devices shall be connected to initiating device circuits (IDC), Style D or to signal line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification or indicating appliances shall be connected to indicating appliance circuit (IAC), Style W in accordance with NFPA 72. A separate circuit shall be provided for actuation of each individual automatic water control valve. The circuits that actuate the water control valves shall be fully supervised so that the occurrence of a single open or a single ground fault condition in the interconnecting conductors shall be indicated at the control panel.

1.3 SYSTEM OPERATIONAL FEATURES

The system shall include a heat detection system, manual actuation stations, supervisory and alarm switches, alarm notification appliances, control panel and associated equipment. Preaction sprinkler system piping shall be provided with supervisory air pressure not to exceed 30 psig.

A. System Actuation: Activation of any single heat detectors or a single manual actuation station shall actuate alarm zone circuits of the control panel which, in turn, shall actuate the respective automatic water control valve. Actuation of the automatic water control valve shall cause water to fill the preaction system piping and be discharged from fused sprinklers.

B. Alarm Functions: Activation of any heat detector or sprinkler pressure alarm switch or manual actuation station shall cause the illumination of the respective zone annunciator, and activation of the building fire alarm system. Valve tamper alarm shall be monitored by the system control panel.

C. Supervisory Functions: The reduction of supervisory air pressure within the sprinkler system piping to less than 10 psi or the occurrence of a single open or a single ground fault in any alarm initiating device circuit, in the automatic water control valve actuation circuit, in any alarm indicating appliance circuit or in other electrically supervised circuit shall cause the individually labelled control panel trouble light to be illuminated, the audible trouble alarm to be activated, and a trouble alarm to be transmitted to the building fire alarm control panel.

1.4 SUBMITTALS: Submit under provisions in Section 01300 and 0100 General Requirements.

A. Sprinkler System Equipment: Manufacturer's Catalog Data for each piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

B. Hydraulic Calculations: Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

C. Battery Calculations: Calculations shall be provided to substantiate the total requirements for supervisory and alarm power. Ampere-hour requirements for each system component and each control panel component or module, under both normal and alarm conditions shall be included. The battery recharging period shall be provided.

D. Spare Parts: Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

E. Sprinkler System Shop Drawings: Detail drawings conforming to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

1. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

2. Floor plans drawn to a scale not less than 1/8"= 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

3. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

4. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

5. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building.

6. Complete point-to-point wiring diagram of the detection and control system. Indicate the detailed interconnection of control panel modules to the devices, the number and size of conductors in each conduit, and size of conduit. Connection points shall be indicated and coordinated with the terminal identification marked on the devices. Complete internal wiring schematic of the control panel and each electrical device shall be provided. Detailed description of the functions of the control panel and each module shall be provided.

F. As-Built Drawings: As-built drawings, no later than 14 days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after all associated work is completed and shall be submitted on reproducible full-size mylar film.

G. Test Procedures: Proposed test procedures for piping hydrostatic test, detection and control system tests, and trip-tests of automatic water control valve, at least 14 days prior to the start of related testing.

H. Preliminary Tests: A schedule of preliminary tests, at least 14 days prior to the proposed start of tests.

I. Final Test: Upon successful completion of tests specified in paragraph PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the final test. Notification shall include a copy of the Contractor's Material & Test Certificates.

J. Contractor's Material & Test Certificates: Certificates, as specified in NFPA 13, shall be completed and signed by the Contractor's representative performing required tests for both underground and aboveground piping.

K. Sprinkler System: Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

1.5 HYDRAULIC CALCULATIONS

A. Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source or to the point where flow test data was measured. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculations. A summary sheet listing all sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For grid systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for grid systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.6 SUBMITTAL PREPARER'S QUALIFICATIONS

A. The sprinkler system submittals, including as-built

drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014.

1.7 INSTALLER QUALIFICATIONS

A. The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.8 REGULATORY REQUIREMENTS

A. Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer. Refer to section 01570 for local fire department involvement requirements.

1.9 DELIVERY AND STORAGE

A. Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

A. Standard Products: Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

B. Requirements for Fire Protection Service: Unless otherwise specified, equipment and materials shall have been tested by Underwriters' Laboratories, Inc. and listed in UL-04 or approved by Factory Mutual and listed in FM P7825. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL-04 or FM P7825.

C. Nameplates: Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, voltage and current rating and catalog number on a metal plate permanently affixed to the equipment.

2.2 ABOVEGROUND PIPING SYSTEMS

A. Piping Systems: Sprinkler piping shall be galvanized steel pipe. The inside wall of the pipe shall be galvanized in addition to the exterior. Steel piping shall be Schedule 40 for sizes less than 8 inches in diameter and Schedule 30 or 40 for sizes 8 inches and larger in diameter. Piping shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

B. Fittings for Non-Grooved Piping: Fittings shall be cast iron conforming to ASME B16.4, galvanized steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

C. Grooved Mechanical Joints and Fittings: Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gaskets shall be

of silicon compound and approved for dry fire protection systems. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

D. Flanges: Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type. Bolts shall be square-head conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

E. Pipe Hangers: Hangers shall be listed in UL-04 or FM P7825 and be of the type suitable for the application, construction, and size pipe involved.

F. Valves:

1. Control Valve and Gate Valve: Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) gate valves and shall be listed in UL-01 or FM P7825.

2. Check Valves: Check valves 2 inches and larger shall be listed in UL-01 or FM P7825. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.3 AUTOMATIC WATER CONTROL VALVE (DELUGE VALVE)

A. Automatic water control valve (deluge valve) shall be electrically-actuated and rated for a working pressure of 175 psi. Valve shall be capable of being reset without opening the valve. Electrical solenoid valve used to actuate the water control valve shall be an integral component of the valve or shall be approved for use by the water control valve manufacturer. Solenoid valve shall be rated at 24 volts direct current, and shall be normally closed type which operates when energized. Solenoid valves shall be rated for a maximum pressure differential of 175 psi. Water control valve shall be equipped with a means to prevent the valve from returning to the closed position until being manually reset. Assembly shall be complete with the valve manufacturer's standard trim piping, drain and test valves, pressure gauges, and other required appurtenances. Each assembly shall include an emergency release device for manually tripping the water control valve in the event of a power or other system failure. Device shall be a standard accessory component of the valve

manufacturer and shall be labeled as to its function and method of operation. Valves located in hazardous locations shall be approved for the hazard classification of the area where located.

2.4 SPRINKLERS

Sprinklers for preaction systems shall be automatic, fusible solder or glass bulb type, with a temperature classification of ordinary. Closed-head sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Sprinklers shall be used in accordance with their listed spacing limitations.

A. Upright Sprinkler: Upright sprinkler shall be brass. Closed-head sprinklers shall be standard response type response type which incorporates a fast acting heat responsive heat element. Sprinkler shall have an orifice of 1/2 inch or 17/32 inch in diameter.

B. Pendent Sprinkler: Pendent sprinkler shall be semi-recessed type. Pendent sprinkler shall be chrome-plated. Closed-head sprinkler shall be standard response type. Sprinkler shall have an orifice of 1/2 inch or 17/32 inch in diameter.

C. Corrosion Resistant Sprinkler: Corrosion resistant sprinkler shall be listed in UL-04. Sprinkler shall be upright type installed in locations as indicated. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.

2.5 DISINFECTING MATERIALS

A. Liquid Chlorine: Liquid chlorine shall conform to AWWA B301.

B. Hypochlorites: Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.6 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

2.7

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 150 psi. The maximum pressure loss

shall be 6 psi at a flow rate equal to the sprinkler water demand, at the location of the assembly.

2.8 ACCESSORIES

A. Sprinkler Cabinet: Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required, shall be provided.

B. Pendent Sprinkler Escutcheon: Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish of polished chrome.

C. Pipe Escutcheon: Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set-screw.

D. Sprinkler Guard: Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in arms vaults.

E. Identification Sign: Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.9 CONTROL PANEL

Panel shall be UL listed or FM approved for "Releasing Device Service" or shall have modules approved for this purpose. Panel shall contain all components and equipment required to provide the specified operational and supervisory functions of the system. Components shall be housed in a surface-mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly factory assembled and wired unit. Panel shall include integral "power on," "alarm," and "trouble" lamps with annunciation of each alarm, supervisory and trouble signal. The panel shall have prominent rigid plastic or metal identification plates for lamps, zones, controls, meters, fuses, and switches. Nameplates for fuses

shall also include ampere rating. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meter and lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

A. Zone Annunciator: Visual annunciators shall be provided for each active zone and spare zone. A separate alarm and trouble lamp shall be provided for each zone and shall be located on exterior of cabinet door or be visible through the cabinet door. A minimum of two spare alarm zones that are fully operational shall be provided. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic or metal sign with either raised or engraved letters. Zone identification shall consist of a unique zone number as well as a word description of the zone.

B. Primary Power Supply: Primary power and trouble alarm power to Control Panel shall be supplied from two 120 VAC circuits. A separate panel connected ahead of the main building panel shall be provided. Panel shall be equipped with 2 20-amp circuit breakers for each control panel and with key lock. Panel disconnect switch shall be permanently marked "PREACTION SPRINKLER SYSTEM".

C. Emergency Power Supply: Emergency power shall be provided for system operation in the event of failure of the primary power supply and shall consist of rechargeable storage battery system. Transfer from normal to emergency power or restoration from emergency to normal power shall be automatic and shall not cause transmission of a false alarm.

1. Storage Batteries: Storage Batteries shall be sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the system for a period of 90 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all alarm indicating devices in the alarm mode for a minimum period of 15 minutes. Battery cabinet shall be a separate compartment at the bottom of the control panel. The battery cabinet shall have twice the volume of the batteries. Batteries shall sit on a noncorrosive and nonconductive base or pad.

2. Battery Charger: Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel cabinet.

2.10 ALARM INITIATING DEVICES

A. Heat Detectors: Detectors located in areas subject to moisture, exterior atmospheric conditions or hazardous locations as defined in NFPA 70 shall be approved for such locations. Detectors shall be listed or approved for 50 foot spacing between detectors. The detector shall be equipped with an alarm indicating light in its base that lights when the detector is in an alarm condition. Five spare detectors of each type and temperature rating shall be provided. At minimum, provide one detector per room.

1. Combination Fixed-Temperature/Rate-of-Rise Heat Detector: Detector shall consist of two independently operated thermal elements. The rate-of-rise portion of the detector shall consist of an air chamber, flexible metal diaphragm and a moisture-proof calibrated vent which will respond to a temperature rise exceeding 15 degrees F per minute. This portion of the detector shall be self-restoring after actuation. The fixed temperature portion of the detector shall consist of a fusible alloy which will melt and cause an alarm when the surrounding air rises above the temperature rating of the detector. The detector shall provide an external indication when the fixed temperature portion of the detector actuates. Detector shall have a temperature classification rating of ordinary as defined by NFPA 72.

B. Manual Actuation Station: Station shall be mounted at 42 inches above the floor, unless otherwise shown. Station shall be arranged to activate the deluge system. Station shall be dual-action type requiring two separate operations in order to cause system discharge. Station shall be colored a unique color dissimilar to color used for manual fire alarm system. Station shall be provided with a positive visible indication of operation of the station. Station shall be weatherproof type and shall be provided with an engraved label indicating DELUGE SYSTEM. Provide station at all doors leading out of area to be protected by

preaction system.

C. Sprinkler Pressure Alarm Switch (Waterflow Alarm): Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches. The switch shall have a service pressure rating of 175 psi. There shall be two SPDT (Form C) contacts factory adjusted to operate at 4 to 8 psi.It shall be possible to mount the switch in any position in the alarm line trim piping of the automatic water control.

D. Valve Supervisory (Tamper) Switch: Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.11 WIRING

A. Wiring for alternating current (AC) circuits shall be 12 AWG minimum. Wiring for low voltage direct current (DC) circuits shall be No. 16 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in electrical metallic tubing or in metallic conduit, except rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same function shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, alarm indicating, supervisory, and actuation circuits are prohibited.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. The installation shall be in accordance with the applicable provisions of publications referenced herein.

3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be installed straight and bear evenly on hangers and supports.

A. Protection of Piping Against Earthquake Damage: The system piping shall be protected against damage from earthquakes. Seismic protection of the piping system shall be provided in accordance with NFPA 13 and Appendix A, with the exception that the "Earthquake Zones" map of Appendix A

shall not apply to this project. Seismic protection shall include flexible couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes. Branch lines shall be equipped with sway braces at the end sprinkler head and at intervals not exceeding 30 ft.

B. Piping in Exposed Areas: Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

C. Piping in Finished Areas: In areas with suspended or dropped ceilings and in areas with concealed spaces above in the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

D. Pendent Sprinklers: Sprinklers installed in the pendent position shall be of the listed dry pendent type, unless otherwise indicated. Dry pendent sprinklers shall be of the required length to permit the sprinkler to be threaded directly into a branch line tee. Where pendent sprinklers are installed below suspended or dropped ceilings, sprinklers shall be of a uniform depth throughout the finished space. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Hangers shall be provided on arm-overs exceeding 12 inches in length.

1. Pendent Sprinkler Locations: Pendent sprinklers located in areas with suspended ceilings shall be positioned a minimum of 6 inches horizontally from the ceiling grid.

E. Upright Sprinklers: Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

F. Pipe Joints: Pipe joints shall conform to NFPA 13. Not more than four threads shall show after joint is made up. Flanged joints shall be provided where indicated or required by NFPA 13.

G. Reducers: Reductions in pipe sizes shall be made with

one-piece tapered reducing fittings. The use of grooved end or rubber-gasket reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

H. Pipe Penetrations: Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core drilled and provided with pipe sleeves. Each sleeve shall be of Schedule 40 galvanized steel pipe, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide the required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07270 FIRESTOPPING. In penetrations which are not fire-rated or are not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

I. Escutcheons: Escutcheons shall be provided for pipe penetrations of ceilings and walls in exposed areas. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

J. Drains: Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Velocity drip from fire department connection check valve shall drain to the outside. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

K. Identification Signs: Signs shall be affixed to each control valve, main drain, auxiliary drain, test valve, and similar valves. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.3 ELECTRICAL WORK

Unless otherwise specified herein, power supply equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

A. Overcurrent and Surge Protection: All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. Cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

B. Grounding: Grounding shall be provided to building ground.

C. Wiring: System field wiring shall be installed in 3/4 inch minimum diameter electrical metallic tubing or metallic conduit. Wiring for the sprinkler system fire detection and control system shall be installed in tubing or conduits dedicated for that use only and not installed in conduit, outlet boxes or junction boxes which contain lighting and power wiring or equipment. Circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked and labeled in accordance with the wiring diagram. No more than one conductor shall be installed under any screw terminal. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors is not permitted. Wiring within any control equipment shall be readily accessible without removing any component parts. Conductors shall be color-coded and shall be identified within each enclosure where a connection or termination is made. Conductor identification shall be by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Circuits shall be wired to maintain electrical supervision so that removal of any single wire from any device shall cause a "trouble" condition on the control panel.

D. Control Panel: The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 24 inches nor more than 78 inches above the finished floor.

E. Detectors: Detectors shall be ceiling-mounted per NFPA 72 and shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location.

F. Manual Actuation Stations: Manual actuation stations shall be mounted readily accessible and 42 inches above the finished floor.

G. Notification Appliances: Notification appliances shall be mounted a minimum of 8 feet above the finished floor unless limited by ceiling height.

3.4 STERILIZATION

A. After system components have been installed and pressure tested, each portion of the completed system shall be sterilized. After pressure tests have been made, the portion to be sterilized shall be thoroughly flushed with water until entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump, shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall be then flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly sterilized containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilization shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.5 FIELD PAINTING AND FINISHING

A. Field painting and finishing are specified in Section 09900 PAINTING, GENERAL.

3.6 PRELIMINARY TESTS

The system including the underground water mains, the aboveground piping, detectors and control system and system components shall be tested to assure that equipment and

components function as intended. Upon completion of specified tests, the contractor shall complete certificates as specified in paragraph SUBMITTALS.

A. Flushing: Underground water mains shall be flushed in accordance with NFPA 13 and NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

B. Hydrostatic Tests: The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

C. Detection and Control System Tests: Upon completion of the installation, the detection and control system shall be subjected to functional and operational performance tests including tests of each installed initiating device, system actuation device and notification appliance. The control system tests specified in paragraph FINAL ACCEPTANCE TEST shall be conducted to ensure that the system is completely functional and that wiring has been properly connected. If deficiencies are found, corrections shall be made and the system shall be retested to assure that the systems has no deficiencies.

D. Automatic Water Control Valve Test: Each water control valve shall be independently trip-tested in accordance with the manufacturer's published instructions. Each valve shall be electrically trip-tested by actuating a respective heat detector and a manual actuation station connected to the control panel and a manual actuation device which is part of the valve trim. A full-flow main drain test shall be made. For preaction systems with supervisory air, the air pressure shall be reduced to verify proper operation of the air supply system and associated supervisory alarm devices.

3.7 FINAL TEST

A complete test of the system shall be conducted to demonstrate that the system is completely functional, that required supervisory and back-up features are provided, and that the system is correctly wired. A technician employed by the

installing Contractor shall be present for tests and shall provide a complete demonstration of the operation of the system. The representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until all identified discrepancies have been corrected and all test documentation is properly completed and received.

A. Control System Test: Testing shall be in accordance with NFPA 72. The test shall include the following:

1. Visual inspection of wiring connections.

2. Opening the circuit at each alarm initiating device, solenoid valve, and notification appliance to test the wiring and supervisory features.

3. Test of each function of the control panel.

4. Test of each circuit in the normal, open and ground fault modes.

5. Test of each initiating device in both normal and trouble conditions.

6. Test of each control circuit and device.

7. Test of each alarm notification appliance.

8. Test of the battery charger and batteries.

9. Operational tests under emergency power supply, including activation of connected alarm notification appliances for the specified time period.

B. Trip-tests of Automatic Water Control Valves: Each water control valve shall be independently trip-tested in accordance with the manufacturer's published instructions. Each valve shall be electrically trip-tested by actuating a respective heat detector, a manual actuation station connected to the system control panel and the manual release which is part of the valve trim. Each valve shall be returned to normal condition after each test. Control valves on preaction systems shall remain open until piping is filled with water.

END OF SECTION

SECTION 15410

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valves.

C. Sanitary sewer piping system.

D. Domestic water piping system.

E. Natural gas piping system.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15140 - Supports and Anchors: Placement of pipe sleeves.

1.3 RELATED SECTIONS

A. Section 02222 - Excavating

B. Section 02223 - Backfilling

C. Section 02225 - Trenching

D. Section 02675 - Disinfection of Water Distribution System

E. Section 08305 - Access Doors

F. Section 09900 - Painting

G. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

H. Section 15121 - Expansion Compensation

I. Section 15140 - Supports and Anchors

J. Section 15190 - Mechanical Identification

K. Section 15245 - Vibration Isolation

L. Section 15260 - Piping Insulation

M. Section 15430 - Plumbing Specialties

N. Section 15440 - Plumbing Fixtures

O. Section 15450 - Plumbing Equipment

1.4 REFERENCES

A. ANSI B31.1 - Power Piping

B. ANSI B31.2 - Fuel Gas Piping

C. ANSI B31.4 - Liquid Petroleum Transportation Piping Systems

D. ANSI B31.9 - Building Service Piping

E. ASME - Boiler and Pressure Vessel Code

F. ASME Sec. 9 - Welding and Brazing Qualifications

G. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800

H. ASME B16.3 - Malleable Iron Threaded Fittings

I. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250

J. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings

K. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings

L. ASME B16.23 - Cast Copper Alloy Solder-Joint Drainage Fittings - DWV

M. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes

N. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

O. ASME B16.32 - Cast Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems

P. ASTM A47 - Ferritic Malleable Iron Castings

Q. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless

R. ASTM A74 - Cast Iron Soil Pipe and Fittings

S. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

T. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

U. ASTM B32 - Solder Metal

V. ASTM B42 - Seamless Copper Pipe

W. ASTM B43 - Seamless Red Brass Pipe

X. ASTM B75 - Seamless Copper Tube

Y. ASTM B88 - Seamless Copper Water Tube

Z. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube

AA. ASTM B302 - Threadless Copper Pipe (TP)

AB. ASTM B306 - Copper Drainage Tube (DMV).

AC. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe

AD. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings

AE. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

AF. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings

AG. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

AH. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings

AI. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)

AJ. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

AK. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings

AL. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

AM. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) Composite-Sewer Piping

AN. ASTM D2683 - Socket-Type Polyethylene Fillings for Outside

Diameter-Controlled Polyethylene Pipe

AO. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

AP. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

AQ. ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.

AR. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

AS. ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

AT. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

AU. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AV. ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

AW. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Pipe

AX. AWS A5.8 - Brazing Filler Metal

AY. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids

AZ. AWWA C110 - Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

BA. AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings

BB. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

BC. AWWA C651 - Disinfecting Water Mains

BD. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems

BE. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems

BF. CAN-3 B281 - Aluminum Drain, Waste, and Vent Pipe and

Components

BG. NCPWB - Procedure Specifications for Pipe Welding

BH. NFPA 54 - National Fuel Gas Code
BI. NFPA 58 - Storage and Handling of Liquified Petroleum Gases

1.5 SUBMITTALS: Submit under provisions of Section 15010.

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 15010.

B. Record actual locations of valves.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 15010.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.8 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

C. Welders Certification: In accordance with ASME Sec 9 NCPWB Standard Procedure Specifications.

D. Maintain one copy of each document on site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum three years documented experience.

1.10 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State, Local, SPCC, NFPC, UPC and BOCA plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01300 and 15010.

B. Accept valves on site in shipping containers with labelling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding are wet or frozen.

1.13 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide two repacking kits for each size valve.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.

1. Fittings: Cast iron
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Aluminum DWV Pipe: CAN-3 B281 ASSE 1045-87 coated.

1. Fittings Cast iron
2. Joints: ASTM C564, thermoplastic rubber coupling and stainless steel clamps.

C. Copper Tubing: ASTM B306, DWV

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
2. Joints: ASTM B32, solder, Grade 50B.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight

1. Fittings: Cast iron
2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Aluminum DWV Pipe: CAN 3-B281

1. Fittings: Cast iron
2. Joints: ASTM C564, thermoplastic rubber coupling and stainless steel clamps.

D. Brass Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR-26 for not less than 150 psig pressure rating.

1. Fittings: ASTM D2466, PVC.
2. Joints: ASTM D2855, solvent weld with ATM D2564 Solvent cement.

2.3 WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Copper Tubing: ASTM B88, Type K, hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

B. Copper Tubing: ASTM B88, Type K annealed.

1. Fittings: ASME B16.26, cast bronze
2. Joints: Flared.

2.4 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type K, L hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

2.5 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Steel Pipe: ASTM A53 or A120, Schedule 40 black, covered with polyethylene jacket (AWWA C105).

1. Fittings: ASTM A234, forged steel welding type, with AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
2. Joints: ANSI B31.2 welded.

2.6 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53 or A120, Schedule 40 black.

1. Fittings: ASTM b16.3, MALLEABLE IRON OR ASTM 234, forged steel welding type.
2. Joints: NFPA 54, threaded or welded to ANSI B31.2.

2.7 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches (50 mm) and Under:

1. Ferrous pipe: 150 psig (1 034 kPa) malleable iron threaded unions.
2. Copper tube and pipe: 150 psig (1 034 kPa) bronze unions with soldered joints.

B. Pipe Size Over 2 Inches (50 mm):

1. Ferrous pipe: 150 psig (1 034 kPa) forged steel slip-on flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.
2. Copper tube and pipe: 150 psig (1 034 kPa) slip-on bronze flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.8 GATE VALVES

A. Acceptable Manufacturers:

1. Nibco
2. Hammond Valve Corp.
3. Stockham
4. Crane

B. Up to and including 3 inches (50 mm): not acceptable.

C. Over 3 inches (50 mm): Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.9 GLOBE VALVES

A. Acceptable Manufacturers:

1. Nibco
2. Hammond Valve Corp.
3. Stockham
4. Crane

B. Up to and including 2 inches (50 mm): Bronze body, bronze trim, rising stem, handwheel, inside screw, renewable composition disc, solder or threaded ends, with back seating capacity (repackable under pressure).

C. Over 2 inches (50 mm): Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.10 BALL VALVES

A. Acceptable Manufacturers

1. Nibco
2. Hammond

B. All sizes: Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle solder or threaded ends.

2.11 PLUG VALVES

A. Acceptable Manufacturers:

1. Rockell

B. Up to and including 2 inches (50 mm): cast iron tapered plug, lubricated, teflon washer, threaded ends.

C. Over 2 inches (50 mm): Cast iron body and plug, lubricated, teflon washer, flanged ends.

2.12 FLOW CONTROLS (BALANCING)

A. Acceptable Manufacturers:

1. Hammond

B. Construction: Brass or bronze body with union on inlet temperature and pressure test plug on inlet and outlet.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psig (24 kPa).

2.13 SWING CHECK VALVES

A. Manufacturers:

1. Hammond
2. Nibco
3. Grinnell

B. Up to and including 2 inches (50 mm): Bronze body, bronze swing disc, solder or screwed ends.

C. Over 2 inches (50 mm): Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

2.14 WATER PRESSURE REDUCING VALVES

A. Acceptable Manufacturers:

1. Watts
2. Hersey
3. Febco

B. Up to 2 Inches (50 mm): Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and single union ends.

C. Over 2 Inches (50 mm): Cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.15 STRAINERS

A. Acceptable Manufacturers

1. Watts
2. Mueller
3. Wilkins

B. Size 2 inch (50 mm) and Under: Screwed brass or iron body

for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm): Flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

D. Size 5 inch (125 mm) and Larger: Flanged iron body for 175 psig (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

PART 3 EXAMINATION

3.1 EXECUTION

A. Prior to submitting bid, visit the site of the proposed construction and thoroughly investigate existing utilities, working conditions to be encountered etc. No additional compensations shall be allowed for conditions increasing cost which were not known when submitting proposal if the condition was obvious and could have been discovered during a site visit.

3.2 PREPARATION

A. Excavation

1. Perform all excavating as required to make plumbing installation. Establish all lines and elevations prior to opening trenches and be responsible for correctness thereof.
2. Where trenches are excavated to grade such that the bottom of the trench forms the bed for the pipe, a solid and continuous bearing shall be provided between joints, and bell holes shall be provided at points where the pipe is joined, and the pipe shall not be supported on blocks to grade.
3. Where trenches are excavated below grade such that the bottom of the trench does not form the bed for the pipe, the trench shall be backfilled to grade with sand or fine gravel placed in layers of 6 inches (152 mm) maximum depth and compacted after each placement. Where rock is encountered in trenching, it shall be removed to a minimum of 3 inches (76 mm) below the grade line of the trench, and the trench shall be backfilled to grade with sand tamped in place so as to provide a uniform bearing for the pipe between joints. The pipe shall not rest on rock at any point including the joints.
4. If soft materials of poor bearing qualities are found at the bottom of the trench, stabilization shall be

achieved by over excavating a minimum of two pipe diameters and bringing up to grade with fine gravel or crushed stone or a concrete foundation. Such a concrete foundation shall be bedded with sand tamped in place so as to provide a uniform bearing for the pipe between joints.

B. Backfilling

1. Loose earth, free of rocks, broken concrete, frozen chunks and other rubble, shall be placed in the trench in 6-inch layers and tamped in place. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that it retains alignment.

C. Pipe Preparation

1. Ream pipe and tube ends. Remove burrs.
2. Remove scale and dirt, on inside and outside, before assembly.
3. Prepare piping connection to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08305.

I. All piping installed in walls or attic spaces that are subject to freezing conditions shall be protected from freezing with heat tape and insulation.

J. After pipe joints have "set" and test has indicated leakproof installation, any water in trench shall be removed and backfill shall be brought to required grade.

K. All water and sewer lines shall be installed below freeze line, with water piping buried a minimum of 54 inches.

L. Provide all sheathing and bracing, using the proper materials, where necessary for the work involved.

M. Maintain all excavations required herein free of standing water.

N. After all backfilling has been completed, remove all surplus excavation material from the Owner's property.

O. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

P. Provide support for utility meters in accordance with requirements of utility companies.

Q. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 09900.

R. Excavate in accordance with Sections 02222 and 02225 for work of this Section.

S. Backfill in accordance with Sections 02223 and 02225 for work of this Section.

T. Install bell and spigot pipe with bell end upstream.

U. Install valves with stems upright or horizontal, not inverted.

V. Provide one plug valve wrench for every ten plug valves sized 2 inches (150 mm) and smaller, minimum of one. Provide each plug valve sized 2-12 inches and larger with a wrench with set screw.

W. Pipe vents from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper

piped system. Sweat solder adapters to pipe.

END OF SECTION

SECTION 15430

PLUMBING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floor drains.

B. Cleanouts.

C. Hose bibs.

D. Hydrants.

E. Water hammer arrestors.

F. Interceptors.

G. Thermostatic mixing valves.

H. Catch basins and manholes.

I. Water Meters

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 02730 - Sanitary Sewers: Placement of concrete manhole bases.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1.4 RELATED SECTIONS

A. Section 02607 - Manholes and Covers

B. Section 15410 - Plumbing Piping.

C. Section 15440 - Plumbing Fixtures.

D. Section 15450 - Plumbing Equipment.

1.5 REFERENCES

A. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

B. ANSI A112.21.1 - Floor Drains.

C. ANSI A112.21.2 - Roof Drains.

D. ANSI A112.26.1 - Water Hammer Arrestors.

E. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

F. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

G. PDI WH-201 Water Hammer Arresters.

1.6 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

D. Manufacturer's Certificate: Certify that grease interceptors meet or exceed specified requirements.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of equipment, cleanouts, backflow preventers grease traps.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Operation Data: Indicate frequency of treatment required for interceptors.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Accept specialties on site in original factory packaging. Inspect for damage.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide two sets of loose keys and service kit for backflow preventers

PART 2 PRODUCTS

2.1 FLOOR DRAINS

A. FD-1: ANSI A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.2 CLEANOUTS

A. Exterior Surfaced Areas (CO-1): Round cast nickel bronze access frame and non-skid cover.

B. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated gasketed cover.

C. Interior Finished Floor Areas (CO-3): Lacquered cast iron, two piece body with flange, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.

D. Interior Finished Wall Areas (CO-4): Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

E. Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.3 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors
Acceptable Manufacturers
a. Wade
b. Josam
c. Zurn

B. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250 psig (1700 kPa) working pressure.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Pipe relief from back flow preventer to nearest drain.

E. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories and sinks.

END OF SECTION

SECTION 15440

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Service sinks.

F. Electric water coolers.

G. Showers.

H. Wash fountains.

I. Eyewash fountains.

J. Emergency showers.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 11400 - Food Services Equipment: Supply of kitchen fixtures for placement by this Section.

1.3 RELATED SECTIONS

A. Section 11400 - Custom Casework: Lavatory tops.

B. Section 07900 - Joint Sealers: Seal fixtures to walls and floors.

C. Section 11400 - Food Services Equipment.

D. Section 15140 - Supports and Anchors.

E. Section 15410 - Plumbing Piping.

F. Section 15430 - Plumbing Specialties.

G. Section 15450 - Plumbing Equipment.

1.4 ALLOWANCES

A. Cash Allowance: Include under provisions of Section 01000.

B. Allowance includes purchase and delivery of owner selected fixtures. Installation is included in this section and is part of the Contract Sum/Price.

1.5 REFERENCES

A. ANSI/ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

B. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

C. ANSI/ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures.

D. ANSI/ASME A112.19.2 - Vitreous China Plumbing Fixtures.

E. ANSI/ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.

F. ANSI/ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards).

G. IAPMO/ANSI Z124.1 - Plastic Bathtub Units.

H. IAPMO/ANSI Z124.2 - Plastic Shower Receptors and Shower Stalls.

I. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

J. ANSI/ARI 1010 - Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers.

1.6 SUBMITTALS: Submit under provisions of Section 15010.

A. Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Manufacturer's Installation Instructions.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 15010.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings and instructed by the manufacturer.

B. Confirm that millwork is constructed with adequate provision for the installation of countertop lavatories and sinks.

PART 2 PRODUCTS

2.1 Water Closet (P-1)

A. Acceptable Manufacturers
1. Water Closet and Seat
a. American Standard
b. Eljer
c. Crane
d. Kohler

B. ANSI/ASME A112.19.2; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch (38 mm) top spud, stainless steel china bolt caps.

C. Flush Valve
1. Acceptable Manufacturers
a. Sloan
b. Zurn
c. Delaney

2. ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker; maximum 1.6 gallons flush volume.

D. Seat

1. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

E. Wall Mounted Carrier
1. Acceptable Manufacturers

a. Wade Division/Tyler Pipe
b. Josam Manufacturing Co.
c. Jay R. Smith Mfg Co.
d. Zurn Industries, Inc.

2. ANSI/ASME A112.6.1; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

F. Install per handicapped requirements.

2.2 LAVATORY

A. Acceptable Manufacturers
Lavatory 4" Centers
a. American Standard
b. Eljer
c. Crane
d. Kohler

Fixture Carriers
a. Wade Division/Tyler Pipe
b. Josam Manufacturing Co.
c. Jay R. Smith Mfg Co.
d. Zurn Industries, Inc.

Faucet and Brass

		Faucet Model Series	Strainer Model	PTrap Model	Supply Stop Model
a.	American Standard	2385	2411.015	4402.012	2306.017
b.	Eljer	571	803-0552	804-1185	802-0310
c.	Crane	-	8-5222	8-5260	8-5000
d.	Kohler	K15181	K-7715	K-9006	K-7600
e.	McGuire	-	1SS-A	8872	158
f.	Eng. Brass Co.	-	SG7	TA125	LA10

B. P-2

1. ANSI/ASME A112.19.2; vitreous china self-rimming counter top lavatory, (refer to plans for size) with drillings on 4 (100 mm) centers, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket.

C. Trim

1. ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator; maximum 2.5 gpm at 80 psig. Single lever handle, (min 4" long handle) chrome plated 17 gage (1.3 mm) brass P-trap with clean-out plug and arm with escutcheon.

D. Wall Mounted Carrier

1. ANSI/ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports for non concrete block walls, bearing plate and studs for concrete block walls.

2.3 SINK

A. P-4

1. Relocate and install existing triple compartment stainless steel sink and trim as shown on the plans.

B. P-6

1. Relocate and install existing pedal operated stainless steel sink and trim hand wash sink, as shown on the plans.

2.4 P-3 SHOWER

A. (Corner) installation, thru-wall supply piping, consisting of: pressure-balancing valve with single spindle and pressure actuated piston contained in spindle, integral stops, #4 brush finish, 18 gauge stainless steel cover, 1/2" copper tubing to head mounted on institutional head bracket fitting; maximum 2.75 gpm when tested in accordance with ASME A112.18.1M. Unit to be vandal proof. Install per ADA requirements.

2.5 SH-1A: HANDICAPPED ACCESSIBLE SHOWER

2.6 ELECTRIC WATER COOLER (P-5)

A. Fountain

1. Acceptable Manufacturers:

a) Haws
b) Sun Roc
c) Halsey TAylor

2. ANSI/ARI 1010; surface handicapped mounted electric water cooler with stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, infra-red control, mounting bracket, refrigerated with integral air cooled condenser.

a) Capacity: 8 gph of 50 degree F (10 degree C) water with inlet at 80 degree F (27 degree C) and room temperature of 90 degree F (32 degree C).
b) Electrical: Maximum 1/5 hp, 6 FLA compressor, 6 foot (2

m) cord and plug for connection to electric wiring system including grounding connector.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid or flexible supplies to fixtures with wheel stops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall carriers and bolts.

F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900.

G. Solidly attach water closets to wall mounted carrier.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust work under provisions of Section 01700.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean work under provisions of 01700.

B. At completion clean plumbing fixtures and equipment.

3.7 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Do not permit use of fixtures.

3.8 FIXTURE HEIGHTS

A. Install fixtures to heights above finished floor as indicated.

B. Water-Closet

1. Standard 15 inches (380 mm) to top of bowl rim.
2. Handicapped per ADA requirements.

C. Urinal

1. Standard 22 inches (560 mm) to top of bowl rim.
2. Handicapped per ADA requirements.

D. Lavatory

1. Standard 31 inches (785 mm) to top of basin rim.
2. Handicapped per ADA requirements.

E. Drinking Fountain

1. Standard 40 inches 1015 mm to top of basin rim.
2. Handicapped per ADA requirements.

F. Water Closet Flush Valves

1. Standard 11 inches (280 mm) min. above bowl rim.

G. Shower Heads

1. Per ADA requirements.

3.9 FIXTURE ROUGH-IN SCHEDULE

	Hot Water	Cold Water	Waste	Vent
Lavatory:	1/2 inch (13 mm)	1/2 inch (13 mm)	1-1/2 inch (38 mm)	1 1/4 inch (32 mm)
Service Sink:	1/2 inch	1/2 inch	2 inch	1 1/2 inch

	(13 mm)	(13 mm)	(50 mm)	(38 mm)
Service Sink:	1/2 inch (13 mm)	1/2 inch (13 mm)	3 inch (75 mm)	1 1/2 inch (38 mm)
Sink:	1/2 inch (13 mm)	1/2 inch (13 mm)	1-1/2 inch (38 mm)	1 1/4 inch (32 mm)
Drinking Fountain:		1/2 inch (13 mm)	1-1/4 inch (32 mm)	1 1/4 inch (32 mm)
Water Closet (Flush Valve):		1 inch (25 mm)	4 inch (100 mm)	2 inch (50 mm)
Urinal (Flush Valve):		3/4 inch (19 mm)	2 inch (50 mm)	1 1/2 inch (38 mm)

END OF SECTION

SECTION 15450

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hot Water/Water Heater.

B. Pumps.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15140 - Supports and Anchors.

C. Section 15245 - Vibration Isolation.

D. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

B. ASME Section VIIID - Pressure Vessels; Boiler and Pressure Vessel Codes.

C. ANSI/NFPA 70 - National Electrical Code.

D. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.

E. ANSI/NEMA 250 - Enclosure for Electrical Equipment (1000 Volts Maximum).

F. ASTM A123 - 1978 zinc (Hot-Galvanized) Coatings on Products

G. ASTM C923 - 1989 Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

H. AWWA-C600 - 1982 Installation of Ductile-Iron Water Mains and Their Appurtenances

I. MSS SP 80 - 1974 Bronze Gate, Globe, Angle, and Check Valves

1.4 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings:

1. Include heat exchanger dimensions. size of tappings, and performance data.
2. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

B. Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements, and affected adjacent construction.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with State and Local Codes.

B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. National Sanitation Foundation (NSF).
2. American Society of Mechanical Engineers (ASME).
3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
4. National Electrical Manufacturers' Association (NEMA).
5. Underwriters Laboratories (UL).
6. American Gas Association (AGA).

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.7 REGULATORY REQUIREMENTS

A. Conform to NBBPVI, AGA, and ANSI/NPFA 54 requirements for water heaters.

B. Conform to ASME Section VIIID for manufacture of pressure vessels for heat exchangers.

C. Conform to ASME Section VIIID for tanks.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.9 WARRANTY

A. Provide five year warranty under provisions of Section 01000 and 15010.

B. Warranty: Include coverage of domestic water heaters, water storage tanks packaged water heating systems and in-line circulator.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

PART 2 PRODUCTS

2.1 IN-LINE CIRCULATOR PUMPS

A. Acceptable Manufacturers:

1. Grundfos
2. Armstrong

B. Casing: Bronze, rated for 125 psig (860 kPa) working pressure.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil

lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

2.2 HOT WATER/WATER HEATER

A. Manufacturers:

1. Bell & Gosset
2. Wessel
3. Adamson
4. Reco

B. Hot water water heater consisting of a horizontal 410 gallon epoxy glass lined steel tank and a twice removed double wall immersion heat exchanger. Tank shall have 16" diameter manhole and 16" high legs. Tank shall be ASME rated.

C. Package shall include pressure relief valve for hot water, hot water pressure gage, water pressure gage and heat exchanger, a factory piped tank circulation system complete with, but not limited to, pipe, fittings, valves, bronze inline circulating pump, pump controls and manual starter with thermal overloads. Package shall also include hot water control valve, temperature transducer and manual setpoint adjustment. Pump shall be supported by the piping and/or the tank. Pump motor horsepower 1/2 hp and less shall be 115V, 1 phase. Pump motor horsepower over 1/2 hp shall be 480V, 3 phase.

D. The heat exchanger section shall be U-tube double wall design. Materials of construction shall be 150 psi rated, iron shell and copper coils. Heat exchanger shall be capable of heating 161 gph, 100 deg. F temperature rise, with 180 deg. F.

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's written instructions and to AGN, NSF and ANSI/NFPA 54 requirements.

B. Coordinate with plumbing piping and related fuel piping and gas venting work to achieve operating system.

3.2 PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 15481

COMPRESSED AIR SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.

B. Reciprocating air compressor.

C. Air receiver and accessories.

D. Aftercooler.

E. Pressure reducing station.

F. Multi reel floor mounted console.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete.

B. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

C. Section 15140 - Supports and Anchors.

D. Section 15190 - Mechanical Identification: Identification of piping system.

E. Section 15245 - Vibration Isolation.

F. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ASME - Boiler and Pressure Vessel Code.

B. ASME B16.3 - Malleable Iron Threaded Fittings.

C. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings.

D. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.

E. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes.

F. ASME B31.1 - Power Piping.

G. ASME B31.9 - Building Services Piping.

H. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

I. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

J. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

K. ASTM B32 - Solder Metal.

L. ASTM B88 - Seamless Copper Water Tube.

M. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.

N. ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter-Controlled Polyethylene Pipe.

O. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.

B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

C. Test Reports: Submit inspector's certificate for air receiver for inclusion in Operating and Maintenance Manuals.

D. Manufacturer's Installation Instructions: Indicate hoisting and setting requirements, starting procedures.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of equipment and components. Modify shop drawings to indicate final locations.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Operation Data: Submit for air compressor, air receiver

and accessories, after cooler, refrigerated air dryer, and pressure reducing station.

C. Maintenance Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable ASME code for installation of pressure vessels.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of air receiver.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Accept air compressors, refrigerated air dryer on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

C. Protect piping and equipment from weather and construction traffic.

1.9 WARRANTY

A. Provide five year warranty under provisions of Section 01000 and 15010.

B. Warranty: Include coverage for reciprocating air compressors.

1.10 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of 01000 and 15010.

B. Provide two quart containers of compressor oil.

PART 2 PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Steel Pipe: ASTM A53 or A120, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.
2. Joints: Threaded or welded to ANSI B31.1.

B. Copper Tubing: ASTM B88, Type K hard drawn.
1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

C. Copper Tubing: ASTM B88, Type K annealed.
1. Fittings: ASME B16.26, cast bronze.
2. Joints: Flared.

2.2 GATE VALVES

A. Gate Valves
1. Acceptable Manufacturers:
a) Nibco
b) Hammond Valve Corp.
c) Stockham
d) Crane

B. Up to and including 3 inches (50 mm): Not acceptable.

C. Over 3 inches (50 mm): Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.3 BALL VALVES

A. Ball Valves
1. Acceptable Manufacturers:
a) Nibco
b) Hammond Valve Corp.

B. All sizes: Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.

C. Air Outlets
1. Quick Connector: 1/2 inch (12 mm) brass, snap on connector with self closing valve.
2. Serrated nozzle with male or female threads for hose to pipe connections.

2.4 UNIONS AND COUPLINGS

A. Unions
1. Ferrous Pipe: 150 psig (1 034 kPa) malleable iron threaded unions.
2. Copper Tube and Pipe: 150 psig (1 034 kPa) bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

C. Flexible Connector: Neoprene with brass threaded connectors.

2.5 COMPRESSOR

A. Acceptable Manufacturers:

1. Ingersoll-Rand

B. Type: Duplex compressor unit consisting of air cooled compressor, air receiver, after cooler, pressure regulating station, spring isolators, motor, and operating controls.

C. Compressor: Cast iron housing and head, heat treated forged steel or ductile iron shaft, aluminum alloy connecting rods, aluminum pistons with rings, high-strength alloy suction and discharge valves, positive automatic lubrication system. Statically and dynamically balance rotating parts.

D. Motor: 460/3/60 voltage, open drip proof.

E. Oil Pressure Switch: Equip compressor to automatically shut down compressor in event of oil pressure failure.

F. Capacity Reduction: Suction valve unloader with lifting mechanism operated by oil pressure, centrifugal force. Provide for unloaded compressor start.

G. Base: One piece ribbed cast iron or welded steel base for motor and compressor with provision for V-belt adjustment.

H. Automatic condensate drain.

I. Aftercooler Construction: Removable tube nests of non-ferrous metal tubes and corrosion resistant tube plates, safety valves, pressure gage, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

J. Working Pressure: 145 psig (931 kPa).

K. Discharge: Cool air to within 12 degrees F (7 degrees C) of ambient air temperature at specified flow capacity.

L. Capacity: 40 cfm at 150 psi.

M. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

N. Air Receiver:
1. built to ASME regulations for working pressure of 145 psi (862 kPa). Flange or screw inlet and outlet connections.

2. Fittings: Adjustable pressure regulator, safety valve, pressure gage, drain cock, and automatic float actuated condensate trap.

3. Tank Finish: Shop painted.

4. Size:
a. Capacity : 120 gallons.

O. Pressure Reducing Station: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage.

P. Valve Capacity: Reduce pressure from 200 psi (1379 kPa) to 30 psi (207 kPa), adjustable upwards from reduced pressure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install compressor unit on concrete housekeeping pad. Refer to Section 03300.

C. Install compressor unit on vibration isolators. Level and bolt in place. Refer to Section 15242.

D. Make air cock and drain connection on horizontal casing.

E. Install line size ball valve and check valve on compressor discharge. Provide flexible connector.

F. Install replaceable cartridge type filter silencer of adequate capacity for each compressor.

G. Place shut off valve on water inlet to aftercooler. Pipe drain to floor drain.

H. Connect condensate drains to nearest floor drain.

I. Install valved bypass around air dryer. Factory insulate

inlet and outlet connections.

J. Install valved drip connections at low points of piping system.

K. Install take offs to outlets from top of main, with shut off valve after take off. Slope take off piping to outlets.

L. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.

M. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

N. Identify piping system and components. Refer to Section 15190.

3.2 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ANSI B31.1.

B. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

C. Cap (seal) ends of piping when not connected to mechanical equipment.

END OF SECTION

SECTION 15510

HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings for:

1. Heating water piping system.
2. Chilled water piping system.
3. Condenser water piping system.
4. Equipment drains and overflows.

B. Valves:

1. Gate valves.
2. Globe or angle valves.
3. Ball valves.
4. Plug valves.
5. Butterfly valves.
6. Check valves.

1.2 RELATED SECTIONS

A. Section 08305 - Access Doors.

B. Section 09900 - Painting.

C. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

D. Section 15121 - Piping Expansion Compensation.

E. Section 15190 - Mechanical Identification.

F. Section 15245 - Vibration Isolation.

G. Section 15260 - Piping Insulation.

H. Section 15515 - Hydronic Specialties.

I. Section 15545 - Chemical Water Treatment: Pipe cleaning.

J. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASME - Boiler and Pressure Vessel Codes, SEC 9 -

Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Braising Operators.

B. ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

E. ASME B31.5 - Refrigeration Piping.

F. ASME B31.9 - Building Services Piping.

G. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

H. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

I. ASTM B32 - Solder Metal.

J. ASTM B88 - Seamless Copper Water Tube.

K. ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

L. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.

M. ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).

N. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.

O. ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

P. ASTM D2467 - Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

Q. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite-Sewer Piping.

R. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

S. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

T. ASTM D2855 - Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

U. ASTM D3309 - Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems.

V. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

W. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

X. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Tubing.

Y. ASTM F876 - Crosslinked Polyethylene (PEX) Tubing.

Z. ASTM F877 - Crosslinked Polyethylene (PEX) Plastic Hot - and Cold - Water Distribution Systems.

AA. AWS A5.8 - Brazing Filler Metal.

AB. AWS D1.1 - Structural Welding Code.

AC. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

AD. AWWA C110 - Ductile - Iron and Grey -Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

AE. AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

AF. AWWA C151 - Ductile-Iron Pipe,Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

AG. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacture.

AH. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

AI. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

AJ. ASTM A 47 Specification for Ferritic Malleable Iron Castings

AK. ASTM A 126 Specification for Gray Iron Castings for Valves, Flanges, & Pipe Fittings

AL. ASTM A 536 Specification for Ductile Iron Castings

AM. ASTM D 2564 Specification for Solvent Cements for PVC Plastic Pipe & Fittings

AN. ASTM D2661 Specification For Acrylonitrile - Butadiene - Styrone (ABS) Schedule 40 Plastic Drain, Waste, & Vent Pipe & Fittings

AO. ASTM D 2672 Specification for Joints for IPS PVC Pipe Using Solvent Cement

AP. ASTM D 2846 Specification For CPVC Plastic Hot & Cold Water Distribution Systems

AQ. ASTM D 3138 Specification for Solvent Cements for Transition Joints Between ABS & PVC Non-Pressure Piping Components

AR. ASTM F 402 Practice For Safe Handling Of Solvent Cements, Primers, & Cleaners Used For Joining Thermoplastic Pipe & Fittings

AS. ASTM F 493 Specification For Solvent Cements For CPVC Plastic Pipe & Fittings

AT. ASME B1.20.1 Pipe Threads, General Purpose

AU. ASME B16.20 Ring - Joint Gaskets & Grooves For Steel Pipe Flanges

AV. ASME B16.21 Nonmetallic Flat Gaskets For Pipe Flanges

AW. ASME B18.2.1 Square & Hex Bolts & Screws

AX. AWS Soldering Manual & Brazing Manual

AY. AWS D10.12 Recommended Practices & Procedures For Welding Low Carbon Steel Pipe

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

C. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

D. Provide pipe hangers and supports in accordance with ASTM B31.9 unless indicated otherwise.

E. Use gate or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers in line sizes above 3". Use ball valves for sizes 3" and below.

F. Use globe, ball or butterfly valves for throttling, bypass, or manual flow control services.

G. Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

H. Use butterfly valves in chilled and condenser water systems interchangeably with gate and globe valves.

I. Use lug end butterfly valves to isolate equipment.

J. Use 3/4 inch (19 mm) ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

K. All exterior piping and supports shall be hot dip galvanized. Repair galvanizing at welded joints with field applied cold galvanizing coumpound

1.5 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

B. Welders Certificate: Include welders certification of compliance with ASME SEC 9.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of valves.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

C. Welders: Certify in accordance with ASME SEC 9.

1.9 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide two repacking kits for each size and valve type.

PART 2 PRODUCTS

2.1 HEATING WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53, Schedule 40, black.

1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
2. Joints: Threaded, or AWS D1.1,welded.

B. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C). Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F (640 - 805 degrees C).

2.2 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53, Schedule 40 black.

1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type.
2. Joints: Threaded or AWS D1.1 welded.

B. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C). Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F (640 - 805 degrees C).

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53, Schedule 40 galvanized.

1. Fittings: Galvanized cast iron, or ASTM B16.3 malleable iron.
2. Joints: Threaded, or grooved mechanical couplings.

B. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C).

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.

1. Fittings: ASTM D2466 or D2467, PVC.
2. Joints: ASTM D2855, solvent weld.

D. ABS Pipe: ASTM D2680 or D2751.

1. Fittings: ASTM D2751.
2. Joints: ASTM D2235, solvent weld.

2.4 PIPE HANGERS AND SUPPORTS

A. Conform to Section 15140.

2.5 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches (51 mm) and Under:

1. Ferrous Piping: 150 psig (1030 kPa) malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 Inches (51 mm):

1. Ferrous Piping: 150 psig (1030 kPa) forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch (1.6 mm) thick preformed neoprene.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.6 GATE VALVES

A. Valves Up To and Including 3 Inches (51 mm): Not acceptable.

B. Valves Over 3 Inches (51 mm):

1. Acceptable Manufacturers:

a) Grinnell Corp.
b) Nibco, Inc.
c) Milwaukee Valve Co.

2. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

2.7 GLOBE OR ANGLE VALVES

A. Valves Up To and Including 2 Inches (51 mm):

1. Acceptable Manufacturers:
a) Grinnell Corp.
b) Nibco, Inc.
c) Milwaukee Valve Co.

2. Bronze body, bronze trim, screwed bonnet, rising stem and handwheel, inside screw, renewable composition disc and bronze seat, solder or threaded ends.

B. Valves Over 2 Inches (51 mm):

1. Acceptable Manufacturers:

a) Grinnell Corp.
b) Nibco, Inc.
c) Milwaukee Valve Co.
2. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.8 BALL VALVES

A. All sizes:

1. Acceptable Manufacturers:

a) Grinnell Corp.
b) Nibco, Inc.
c) Milwaukee Valve Co.
d)
2. Bronze two piece body, stainless steel brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.

2.9 PLUG VALVES

A. Valves Up To and Including 2 Inches (51 mm):

1. Acceptable Manufacturers:

a) Homestead Valve Div.
b) Mueller Steam Specialty Co.
c) Henry Pratt Co.

2. Bronze body, bronze tapered plug, 70 percent full port opening, non-lubricated, teflon packing, threaded ends.
3. Operator: One plug valve wrench for every ten plug valves minimum of one.

B. Valves Over 2 Inches (51 mm):

1. Acceptable Manufacturers:

a) Homestead Valve Div.
b) Mueller Steam Specialty Co.
c) Henry Pratt Co.

2. Cast iron body and plug, full port opening, pressure lubricated, teflon packing, flanged ends.
3. Operator: Each plug valve with a wrench with set screw.

2.10 BUTTERFLY VALVES

A. Acceptable Manufacturers:

1. Grinnell Corp.
2. Nibco, Inc.
3. Milwaukee Valve Co.
4. Stockham, Valves and Fittings Inc.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, lug ends, and extended neck. Wafer type valves shall not be accepted.

C. Disc: Chrome plated ductile iron or stainless steel.

D. Operator: 10 position lever handle Handwheel and gear drive.

2.11 SWING CHECK VALVES

A. Valves Up To and Including 2 Inches (51 mm):

1. Acceptable Manufacturers:

a) Grinnell Corp.
b) Nibco, Inc.
c) Mueller Steam Specialty Co.
d) Stockham, Valves and Fittings Inc.

2. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.

B. Valves Over 2 Inches (51 mm):

1. Acceptable Manufacturers:

a) Grinnell Corp.
b) Nibco, Inc.
c) Mueller Steam Specialty Co.
d) Stockham, Valves and Fittings Inc.

2. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.12 SPRING LOADED CHECK VALVES

A. Acceptable Manufacturers:

1) Grinnell Corp.
2) Nibco, Inc.
3) Mueller Steam Specialty Co.
4) Stockham, Valves and Fittings Inc.

B. Valves shall have iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 15545

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, chilled water, and condenser water to ASME B31.9.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls and floors.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15121.

I. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (102 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

J. Pipe Hangers and Supports:

1. Install in accordance with Section 15140.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (305 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze

hangers.

8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15260.

L. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08305.

M. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

O. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09900.

P. Install valves with stems upright or horizontal, not inverted.

3.3 SCHEDULES

A. Pipe Hanger Spacing.

PIPE SIZE Inches (mm)	MAX. HANGER SPACING Feet (m)	HANGER ROD DIAMETER Inches (mm)
1/2 to 1-1/4 (13 to 32)	6.5 (2.0)	3/8 (10)
1-1/2 to 2 (38 to 51)	10 (3.0)	3/8 (9)
2-1/2 to 3 (64 to 76)	10 (3.0)	1/2 (13)
4 to 6 (102 to 152)	10 (3.0)	5/8 (16)
8 to 12 (203 to 305)	14 (4.3)	7/8 (22)

END OF SECTION

SECTION 15515

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Pump suction fittings.

F. Combination fittings.

G. Flow indicators, controls, meters.

H. Relief valves.

I. Heat Tracing

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15430 - Plumbing Specialties: Backflow Preventers.

C. Section 15510 - Hydronic Piping.

D. Section 15545 - Chemical Water Treatment: Pipe Cleaning.

1.3 CODES AND STANDARDS (Latest Edition or Revision)

A. ASME - Boilers and Pressure Vessel Codes, SEC 8-D-Rules for Construction of Pressure Vessels.

B. ANSI B1.20.1 - Pipe Threads

C. ANSI 16.1 - Cast-Iron Pipe Flanges & Flanged Fittings, Class 25, 125, 250, and 800

D. ANSI B16.3 - Malleable-Iron Threaded Fittings, Class 150 and 300.

E. ANSI B16.4 - Cast-Iron Threaded Fittings, Class 125 and 250.

F. ANSI B16.5 - Pipe Flanges & Flanged Fittings, Steel Nickel Alloy and Other Special Alloys

G. ANSI B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

H. ANSI B16.24 - Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300.

I. ASTM A53 - Specification For Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless

J. ASTM B32 - Specification For Solder Metal

K. ASTM B88 - Specification For Seamless Copper Water Tube

L. ASTM A47 - Specification For Ferritic Malleable Iron Castings

M. ASTM A126 - Specification For Gray Iron Castings For Valves, Flanges, & Pipe Fittings

N. ASTM A536 - Specification For Ductile Iron Castings

O. AWS Soldering Manual and Brazing Manual

P. AWS A5.8 - Specification For Filler Metals For Brazing

Q. AWS D1.1 - Structural Welding Code For Steel

R. AWS D10.12 - Recommended Practices & Procedures For Welding Low Carbon Steel Pipe

1.4 SUBMITTALS: Submit under provisions of Section 01000 and 15010.

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model [and dimensions].

B. Inspection Certificate: Submit inspection certificates for pressure vessels from authority having jurisdiction.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of flow controls.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 DIAPHRAGM-TYPE EXPANSION TANKS

A. Acceptable Manufacturers:

a) Armstrong Pumps, Inc.
b) Bell & Gossett Corp.
c) Taco, Inc.

B. Construction: Welded steel, tested and stamped in accordance with ASME SEC 8-D; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible EPDM diaphragm sealed into tank.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig (80 kPa).

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.2 AIR VENTS

A. Manual Air Vent: Short vertical sections of 2 inch (51 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.

B. Automatic Float Type Air Vent:

1. Acceptable Manufacturers:

a) Armstrong Pumps, Inc.
b) Bell & Gossett Corp.
c) Taco, Inc.

2. Vents shall have brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type Air Vent.

1. Acceptable Manufacturers:

a) Armstrong Pumps, Inc.
b) Bell & Gossett Corp.
c) Taco, Inc.

2. Vents shall have brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.3 AIR SEPARATORS

A. In-line Air Separator:

1. Acceptable Manufacturers:

a) ITT Bell & Gossett Corporation
b) Taco, Inc.
c) Armstrong Pumps, Inc.

2. Air separators shall be cast iron for sizes 1-1/2 inch (38 mm) and smaller, or steel for sizes 2 inch (51 mm) and larger; tested and stamped in accordance with ASME SEC 8-D; for 125 psig (860 kPa) operating pressure.

B. Combination Air Separator/Strainer:

1. Acceptable Manufacturers:

   a) ITT Bell & Gossett Corporation
   b) Taco, Inc.
   c) Armstrong Pumps, Inc.

2. Air separators shall be steel, tested and stamped in accordance with ASME SEC 8-D; for 125 psig (860 kPa) operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.4 STRAINERS

A. Size 2 inch (51 mm) and Under:
   1. Acceptable Manufacturers:

      a) Grinnell Corp.
      b) Metraflex Co.
      c) Armstrong, International, Inc.

   2. Strainers shall have screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

B. Size 2-1/2 inch (64 mm) to 4 inch (102 mm):

   1. Acceptable Manufacturers:

      a) Grinnell Corp.
      b) Metraflex Co.
      c) Armstrong, International, Inc.

   2. Strainers shall have flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

C. Size 5 inch (127 mm) and Larger:

   1. Acceptable Manufacturers:

      a) Grinnell Corp.
      b) Metraflex Co.
      c) Armstrong, International, Inc.

   2. Strainers shall have flanged iron body for 175 psig (1210 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

2.5 PUMP SUCTION FITTINGS

A. Acceptable Manufacturers:

1. Armstrong Pumps, Inc.
2. Bell & Gossett Corp.
3. Taco, Inc.

B. Fittings shall have angle pattern, cast-iron body, threaded for 2 inch (51 mm) and smaller, flanged for 2-1/2 inch (64 mm) and larger, rated for 175 psig (1210 kPa) working pressure, with inlet vanes, cylinder strainer with 3/16 inch (5 mm) diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.6 FLOW CONTROLS

A. Acceptable Manufacturers:

1. Armstrong Pumps, Inc.
2. Bell & Gossett Corp.
3. Taco, Inc.

B. Construction: Brass or bronze body with union on inlet temperature and pressure test plug on inlet and outlet blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psig (24 kPa).

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

E. Accessories: In-line strainer on inlet and ball valve on outlet.

2.7 FLOW METERS

A. Acceptable Manufacturers:

1. Armstrong Pumps, Inc.
2. Metraflex Co.
3. Honeywell, Inc.

B. Meters shall have orifice principle by-pass circuit with direct reading gage, soldered or flanged piping connections for 125 psig (860 kPa) working pressure, with shut off valves, and drain and vent connections.

C. Meters shall be direct reading with insert pitot tube, threaded coupling, for 150 psig (1030 kPa) working pressure, maximum 240 degrees F (115 degrees C), 5 percent accuracy.

D. Meters shall be cast iron, wafer type, orifice insert flow meter for 250 psig (1720 kPa) working pressure, with read-out valves equipped with integral check valves with gasketed caps.

E. Meters shall be calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.

F. Meters shall be cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and gasketed caps.

G. Portable meters shall consist of case containing one, 3 percent accuracy pressure gage with 0-60 feet (0-180 kPa) pressure range for 500 psig (3450 kPa) maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

2.8 RELIEF VALVES

A. Acceptable Manufacturers:

1. Armstrong Pumps, Inc.
2. Amtrol, Inc.
3. ITT Mcdonnell & Miller

B. Valves shall have bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.9 HEAT TRACE

A. Acceptable Manufacturers:

1. Raychem
2. Thermon

B. Self-regulating parallel circulated conductors separated by polymer core which exhibits variable resistance with temperature. Entire assembly shall be encased within a thermoplastic insulating jacket. Electrical characteristics shall be for 208-277 Volts. Heat output shall be 8W per foot minimum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blow down connection.

G. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

H. Support pump fittings with floor mounted pipe and flange supports.

I. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

J. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

K. Pipe relief valve outlet to nearest floor drain.

L. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

END OF SECTION

SECTION 15540

HVAC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Base mounted pumps.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete.

B. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

C. Section 15170 - Motors.

D. Section 15245 - Vibration Isolation.

E. Section 15260 - Piping Insulation.

F. Section 15280 - Equipment Insulation.

G. Section 15510 - Hydronic Piping.

H. Section 15515 - Hydronic Specialties.

I. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. UL 778 - Motor Operated Water Pumps.

B. NFPA 70 - National Electrical Code.

C. ASME B16.1 - Cast-Iron Pipe Flanges & Flanged Fittings, Class 25, 125, 250 and 800.

D. ASTM A36 - Specification For Structural Steel.

E. ASTM B36 - Specification For Brass Plate, Sheet, Strip, and Rolled Bar.

F. ASTM B584 - Specification For Copper Alloy Sand Castings For General Applications.

1.4 PERFORMANCE REQUIREMENTS

A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.5 SUBMITTALS: Submit under provisions of Section 01000 and 15010.

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

C. Millwright's Certificate: Certify that base mounted pumps have been aligned.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three documented years experience.

B. Alignment: Base mounted pumps shall be aligned by qualified millwright.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.9 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide one set of mechanical seals for each pumps.

1.10 TRAINING: Provide under provisions of section 15010.

PART 2 PRODUCTS

2.1 BASE MOUNTED PUMPS

A. Acceptable Manufacturers:

1. Armstrong Pump Inc.
2. ITT Bell & Gossett
3. Paco Pumps, Inc.
4. Amtrol, Inc.
5. Weinman Pumps
6. Aurora Pump

B. Type: Pump shall have horizontal shaft, single stage, direct connected, radially split casing, for 125 psig (860 kPa) maximum working pressure.

C. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

D. Impeller: Bronze, fully enclosed, keyed to shaft.

E. Bearings: Permanently lubricated roller or ball bearings.

F. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

G. Seal: Carbon rotating against a stationary ceramic seat, viton fitted, 275 degrees F (135 degrees C) maximum continuous operating temperature.

H. Drive: Flexible coupling with coupling guard.

I. Baseplate: Cast iron or fabricated steel with integral drain rim.

J. Electrical Characteristics:

1. Refer to Section 16180.
2. Motor: 1750 rpm unless specified otherwise; refer to Section 15170.
3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches (102 mm) and over. Refer to Section 15245.

D. Provide line sized shut-off valve and strainer and pump suction fitting on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base mounted pumps prior to start-up.

H. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03300.

I. Lubricate pumps before start-up.

END OF SECTION

SECTION 15545

CHEMICAL WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical feeder equipment.

C. Chemical treatment.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15510 - Hydronic Piping: Placement of water coupon rack, by-pass (pot) feeder.

1.3 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

C. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. NFPA 70 - National Electrical Code.

1.5 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

D. Manufacturer's Field Reports: Submit under provisions of Section 01000 and 15010.

E. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

F. Certificate: Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer: Company specializing in performing the work of this section with minimum 3 years documented experience and approved by manufacturer.

1.9 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion.

B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

C. Provide laboratory and technical assistance services during this maintenance period.

D. Include two hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.

E. Provide on site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.11 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of 01000 and 15010.

B. Provide sufficient chemicals for treatment and testing during warranty period.

PART 2 PRODUCTS

2.1 MATERIALS

A. System Cleaner:

1. Acceptable Manufacturers:
   a) Anderson Chemical Co.
   b) Aqua-Flo, Inc.
   c) Nalco Chemical Co.

2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
3. Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

B. Closed System Treatment (Water):

1. Acceptable Manufacturers:

   a) Anderson Chemical Co.

b) Aqua-Flo, Inc.
c) Nalco Chemical Co.

2. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
3. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
4. Conductivity enhancers; phosphates or phosphonates.

2.2 BY-PASS (POT) FEEDER

A. Acceptable Manufacturers:

1. Anderson Chemical Co.
2. Aqua-Flo, Inc.
3. Nalco Chemical Co.

B. Feeder shall be 6.0 gal (22.7) quick opening cap for working pressure of 175 psig (1210 kPa).

2.3 SOLUTION TANKS

A. Acceptable Manufacturers:

1. Anderson Chemical Co.
2. Aqua-Flo, Inc.
3. Nalco Chemical Co.

B. Tank shall have 30 gallon (114 L) capacity, polyethylene, self-supporting, 5 gallon (19 L) graduated markings; molded fiberglass cover with recess for mounting pump, agitator, and liquid level switch.

2.4 AGITATOR

A. Acceptable Manufacturers:

1. Anderson Chemical Co.
2. Aqua-Flo, Inc.
3. Nalco Chemical Co.

B. Agitator shall have totally enclosed electric motor, stainless steel clamp and motor mount, 1/2 inch (13 mm) diameter coated Type 316 stainless steel propeller.

C. Electrical Characteristics:

1. Refer to Section 16180.
2. 110 volts, single phase, 60 Hz.
3. Cord and Plug: Provide unit with 6 foot (2 m) cord

and plug for connection to electric wiring system including grounding connector.

2.5 LIQUID LEVEL SWITCH

A. Acceptable Manufacturers:

1. Honeywell, Inc.
2. Lumenite Electronic Co.

B. Switch shall have polypropylene housing with integrally mounted PVC air trap, receptacles for connection to metering pump, and low level alarm.

C. Electrical Characteristics:

1. Refer to Section 16180.
2. 110 volts, single phase, 60 Hz.

2.6 CONDUCTIVITY CONTROLLER

A. Acceptable Manufacturers:

1. Honeywell, Inc.
2. Leslie Controls, Inc.

B. Packaged monitor controller shall have solid state circuiting, five percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control function light, output to control circuit.

C. Electrical Characteristics:

1. Refer to Section 16180.
2. 110 volts, single phase, 60 Hz.

2.7 WATER METER

A. Acceptable Manufacturers:

1. Honeywell, Inc.
2. Armstrong Pumps, Inc.

B. Meter shall be displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

C. Electrical Characteristics:

1. Refer to Section 16180.
2. 110 volts, single phase, 60 Hz.

2.8 SOLENOID VALVES

A. Acceptable Manufacturers:

1. Eaton Corp.
2. Parker Hannifin Corp.
3. Sporlan Valve Co.

B. Valves shall have forged brass body globe pattern, normally open or closed as required, general purpose solenoid enclosure, and continuous duty coil.

C. Electrical Characteristics:

1. Refer to Section 16180.
2. 110 volts, single phase, 60 Hz.

2.9 TIMERS

A. Acceptable Manufacturers:

1. Honeywell, Inc.
2. Lumenite Electronic Co.

B. Electronic timers shall be infinitely adjustable over full range, 150 second and five minute range, mounted together in cabinet with hands-off-automatic switches and status lights.

C. Electrical Characteristics:

1. Refer to Section 16180.
2. 110 volts, single phase, 60 Hz.

2.10 TEST EQUIPMENT

A. Provide white enamel test cabinet with local and fluorescent light, capable of accommodating 4 - 10 ml zeroing titrating burettes and associated reagents.

B. Provide the following test kits:
1. Alkalinity titration test kit.
2. Chloride titration test kit.
3. Sulphite titration test kit.
4. Total hardness titration test kit.
5. Low phosphate test kit.
6. Conductivity bridge, range 0 - 10,000 microhms.
7. Creosol red pH slide complete with reagent.
8. Portable electronic conductivity meter.
9. High nitrite test kit.

PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:

1. As recommended by manufacturer.
2. One pound per 100 gallons (1 kg per 1000 L) of water contained in the system.
3. One pound per 100 gallons (1 kg per 1000 L) of water for hot systems and one pound per 50 gallons (1 kg per 500 L) of water for cold systems.

B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F (71 degrees C) and maintain for 12 hours minimum.
2. Remove heat and circulate to 100 degrees F (37.8 degrees C) or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.

C. Chilled Water Systems:

1. Circulate for 48 hours, then drain systems as quickly as possible.
2. Refill with clean water, circulate for 24 hours, then drain.
3. Refill with clean water and repeat until system cleaner is removed.

D. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.

E. Flush open systems with clean water for one hour minimum. Drain completely and refill.

F. Remove, clean, and replace strainer screens.

G. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch (19 mm) water coupon rack around circulating pumps with space for 4 test specimens.

END OF SECTION

SECTION 15569

WATER HEATING; GAS

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. ANSI Z21.13 - Gas-Fired Low-Pressure Steam and Hot Water Boilers

B. ASME B31.1 - Power Piping

C. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element

D. ASME BPV IV - Boiler and Pressure Vessel Code; Section IV, Heating Boilers

E. ASME BPV IX - Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

F. ASME CSD-1 - Controls and Safety Devices for Automatically Fired Boilers

G. FS W-F-2793 - Fans, Centrifugal, Draft, Forced and Induced (Inch-Pound)

H. HYI-01 - I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation

I. NFPA 85C - Prevention of Furnace Explosions/Implosions in Multiple Burner Boiler-Furnaces

J. NFPA 8501 - Single Burner Boiler Operations

K. UL-06 - Gas and Oil Equipment Directory

L. UL 795 - Commercial-Industrial Gas Heating Equipment

1.2 GENERAL REQUIREMENTS

A. Standard Products: Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service

organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

B. Asbestos Prohibition: Asbestos and asbestos-containing products shall not be used.

C. Nameplates: Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment. Each pressure vessel shall have an approved ASME stamp.

D. Equipment Guards: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Catwalks, operating platforms, ladders, and guardrails shall be provided where shown and shall be constructed in accordance with Section 05500 MISCELLANEOUS METAL.

E. Verification of Dimensions: The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work or ordering any materials.

F. Welding: Boilers and piping shall be welded and brazed in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

1.3 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

1.4 SUBMITTALS: Submit under provisions in Section 01300.

A. Manufacturer's Catalog Data: Manufacturer's catalog data shall be included with the detail drawings for the

following items:

1. Boilers
2. Fuel Burning Equipment
3. Combustion Control Equipment
4. Fittings and Accessories

The data shall show model, size, options, etc., that are intended for consideration. Data submitted shall be adequate to demonstrate compliance with contract requirements.

B. Spare Parts Data: Spare parts data for each different item of material and equipment, after approval of the detail drawings and no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 years of service.

C. Heating System: Detail drawings consisting of equipment layout including installation details and electrical connection diagrams. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

D. Posted Instructions: System layout diagrams that show the layout of equipment, piping, and ductwork and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system, framed under glass or laminated plastic, at least 2 weeks prior to the start of related testing. After approval, these items shall be posted where directed.

E. Tests: Proposed test schedules for the heating system and fuel system tests, at least 2 weeks prior to the start of related testing.

F. Heating System and Fuel System Tests: Test reports for the heating system tests and the fuel system test, upon completion of testing complete with results.

G. Boiler Emissions: Written certification by the boiler manufacturer that each boiler furnished complies with Federal, state, and local regulations for emissions. The certification shall also include a description of

applicable emission regulations. If any boiler is exempt from the emission regulations, the certification shall indicate the reason for the exemption.

H. Heating System: Six complete manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

1.5 MANUFACTURER'S SERVICES

A. Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installing, adjusting, and testing of the equipment.

1.6 DELIVERY AND STORAGE

A. Equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

PART 2 - PRODUCTS

2.1 BOILERS

A. Each boiler shall have the output capacity in British thermal units per hour (Btuh) as indicated when fired with the specified fuels. The boiler shall be furnished complete with the gas burning equipment, boiler fittings and trim, automatic controls, forced draft fan, electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. Boiler auxiliaries including fans, motors, drives, and similar equipment shall be provided with at least 10 percent excess capacity to allow for field variations in settings and to compensate for any unforeseen increases in pressure losses in appurtenant piping and ductwork. However, the boiler safety devices shall not be sized for a 10 percent excess capacity. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and

service. Boilers shall be designed, constructed, and equipped in accordance with ASME BPV IV. Each boiler shall be of the cast iron type and designed for hot water service as specified herein. The boiler capacity shall be based on the ratings shown in HYI-01 or as certified by the American Boiler Manufacturers Association, or American Gas Association.

B. Cast Iron Boiler: Boiler shall be of the rectangular, sectional type, self-contained, packaged type, complete with accessories, mounted on a structural steel base. Cast iron sections shall be free of leaks under all operating conditions. Access shall be provided to permit cleaning of internal tube surfaces.

2.2 FUEL BURNING EQUIPMENT

A. Boiler shall be designed to burn gas. Each boiler shall comply with Federal, state, and local emission regulations.

B. Burners

1. Gas Fired Burners and Controls: Burners shall be UL approved mechanical draft burners with all air necessary for combustion supplied by a blower where the operation is coordinated with the burner. Burner shall be provided complete with fuel supply system in conformance with the following safety codes or standards:

a. Gas-fired units shall conform to UL 795. Gas fired units less than 12,500,000 Btuh input shall conform to ANSI Z21.13.

C. Draft Fans: Fans conforming to FS W-F-2793 forced-draft shall be furnished as an integral part of boiler design. Fans shall be centrifugal with backward-curved blades or axial flow type. Each fan shall be sized for output volume and static pressure rating sufficient for pressure losses, excess air requirements at the burner, leakages, temperature, and elevation corrections for worst ambient conditions, all at full combustion to meet net-rated output at normal firing conditions, plus an overall excess air volume of 10 percent against a 20 percent static overpressure. Noise levels for fans shall not exceed 85 decibels in any octave band at a 3 foot station. Forced draft fan bearings shall be air cooled.

1. Draft Fan Drives: Fans shall be driven by electric motors. Electric motor shall be magnetic

across-the-line type with general purpose enclosure and shall be furnished with four auxiliary interlock contacts.

D. Draft Damper: Boilers shall be provided with automatic dampers, draft hoods, or barometric dampers as recommended by the boiler manufacturer to maintain proper draft in the boiler. Draft damper shall be provided in a convenient and accessible location in the flue gas outlet from the boiler. Automatic damper shall be arranged for automatic operation by means of a furnace draft regulator. If draft dampers are provided than spill switches must be installed as required by NFPA-54, Paragraph 7.12.4.

2.3 COMBUSTION CONTROL EQUIPMENT

A. Combustion control equipment shall be provided as a system by a single manufacturer. Field installed automatic combustion control system shall be installed in accordance with the manufacturer's recommendations and under the direct supervision of a representative of the control manufacturer. The boiler pressure shall be controlled by a pressure controller. The equipment shall operate either electrically or pneumatically. On multiple boiler installations, each boiler unit shall have a completely independent system of controls responding to the load and to a plant master controller. If recording instruments are provided, a 1 year supply of ink and 400 blank charts for each recorder shall be furnished.

B. Electrical Controls: Electrical control devices shall be rated at 120 volts and shall be connected as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

C. Water Temperature Controller: The controller shall be of sturdy construction and shall be protected against dust and dampness. The sensing elements of the water controller shall be in direct contact with the water. Modulating controllers shall automatically maintain, within 2 percent, the desired water temperature by regulating the burner.

D. Boiler Plant Master Controller: A boiler plant master controller, sensitive to a pressure transmitter in the boiler discharge header shall be furnished to provide anticipatory signals to all boiler controllers. Boiler controllers shall react to anticipatory signals from the plant master controller as necessary in response to the boiler pressure indication to maintain the preset pressure. An automatic-manual switch shall be provided

to allow the sequence of boiler loading to be varied to distribute equal firing time on all boilers in the plant. The plant master controller shall load the boilers one at a time as the plant load increases.

E. Boiler Combustion Controls and Positioners:

a. Gas gas-oil fired boiler units shall be provided with modulating combustion controls with gas pilot or spark ignition. Modulating controls shall be provided with a means for manually controlling the firing rate.

b. Modulating control function shall be accomplished using positioning type controls. Air flow ratio and fuel control valve shall be controlled by relative positions of operative levers on a jackshaft responding to a pressure controller. Positioning type combustion control equipment shall include draft controls with synchronized fuel feed and combustion air supply controls, and shall maintain the proper air/fuel ratio. The desired furnace draft shall be maintained within 0.01 inch of water column.

F. Combustion Safety Controls and Equipment: Combustion safety controls and equipment shall be UL listed, microprocessor-based distributed process controller. The controller shall be composed of an EPROM type chip. The system shall include mounting hardware, wiring and cables, and associated equipment. The controller shall be mounted completely wired, programmed, debugged, and tested to perform all of its functions. The controller shall process the signals for complete control and monitoring of the boiler. This shall include maintaining boiler status, starting and stopping all control functions, sequencing control functions and signaling alarm conditions. The program shall be documented and include cross references in description of coils and contacts. Microprocessor shall be able to perform self diagnostics and contain a message center to provide operator with status and failure mode information. Controllers for each boiler shall be mounted on a separate, free standing panel adjacent to the boiler or for packaged boilers on the boiler supporting structure. Control systems and safety devices for automatically fired boilers shall conform to ASME CSD-1. Electrical combustion and safety controls shall be rated at 120 volts, single phase, 60 Hz and shall be connected as specified in Section 16415 ELECTRICAL WORK, INTERIOR. A 4 inch diameter alarm

bell shall be provided and shall be located where indicated or directed. The alarm bell shall ring when the boiler is shut down by any safety control or interlock. Indicating lights shall be provided on the control panel. A red light shall indicate flame failure, and a green light shall indicate that the main fuel valve is open. The following shutdown conditions shall require a manual reset before the boiler can automatically recycle:

a. Flame failure.

b. Failure to establish pilot flame.

c. Failure to establish main flame.

d. Supplementary low-water cutoff.

e. High pressure cutoff.

1. Low-water Cutoff: Low-water cutoff shall be provided to stop the burner and draft fan when the water level drops below a predetermined point. The cutoff shall consist of a float chamber with float, float switch, and drain valve. The float switch shall be mounted on the float chamber with a packless-type leakproof connection. The float mechanism and drain valve shall be constructed of a corrosion-resistant material. The low-water cutoff shall be UL-06 listed and shall be furnished with approved fittings and installed according to ASME boiler code requirements. The following type of low-water cutoff shall be utilized.

   a. Pump Controller with Low-Water Cutoff: Controller shall be a design approved by the boiler manufacturer. A pump controller shall be provided for each boiler which is used for space heating and process loads or long distribution lines. Pump controller shall control the operation of the burner, forced-draft fan, and pump. Pump controller and low-water cutoff shall have a float-operated mercury switch arranged to start and stop the pump at preset boiler water levels. If the water level in the boiler reaches the low danger point, a second mercury switch shall shut down the burner and actuate the alarm bell.

   b. Supplementary Low-Water Cutoff: Supplementary low-water cutoff of the electrically operated

probe type shall be provided in addition to the low-water cutoff required above on each boiler. Supplementary low-water cutoff shall be mounted directly in the boiler shell and shall be set below the low-water cutoff required above.

2.4 HOT WATER AND BOILER CIRCULATING PUMPS

Circulating pumps for hot water shall be electrically driven single-stage centrifugal type and have a capacity not less than indicated. Boiler circulating pumps shall be supported by the piping on which installed and shall be closed-coupled shaft. The boiler circulating pumps shall be vertical split case type. Hot water circulating pumps shall be supported on a concrete foundation with a cast iron or structural steel base and shall have a flexible-coupled shaft. The hot water circulating pumps shall be vertical split case type. The pump shaft shall be constructed of corrosion-resistant alloy steel, sleeve bearings and glands of bronze designed to accommodate a mechanical seal, and the housing of close-grained cast iron. Pump seals shall be capable of withstanding 240 degrees F temperature without external cooling. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for the available electric service, and shall conform to the requirements of paragraph ELECTRICAL EQUIPMENT. Each pump suction and discharge connection shall be provided with a pressure gauge as specified. The boiler circulating pump discharge heater shall be provided with a pressure switch. Pressure switch unit shall be a self-contained snap action type to indicate fluid pressure. Switch shall be A SPDT with 120-volt, 15-ampere rating.

2.5 COLD WATER CONNECTIONS

Connections shall be provided which includes consecutively in line a strainer, backflow prevention device, and water pressure regulator in that order in the direction of the flow. The backflow prevention device shall be provided as indicated and in compliance with local code. Cold water fill connections shall be made to the water supply system as indicated. Necessary pipe, fittings, and valves required for water connections between the boiler and cold water main shall be provided as shown. The pressure regulating valve shall be of a type that will not stick or allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure of approximately, lately 5 psi in excess of the static head on the system and shall operate within a 2 psi tolerance regardless of cold water supply piping pressure and without objectionable noise under any condition of operation.

2.6 AIR HANDLING UNITS

A. Air handling units and associated equipment shall be in accordance with Section 15855 AIR HANDLING UNITS WITH COILS.

2.7 FITTINGS AND ACCESSORIES

A. Boiler fittings and accessories shall be installed with each boiler in accordance with ASME BPV IV, unless otherwise specified.

B. Pressure Gauges: Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shutoff valve. Minimum dial size shall be 3-1/2 inches. A pressure gauge shall be provided for each boiler in a visible location on the boiler.

C. Thermometers: Thermometers shall be provided with wells and separable corrosion-resistant steel sockets. Thermometers for the feedwater for each steam boiler shall be provided in a visible location on the boiler. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a minimum 9 inch scale.

D. Air Vents:

1. Manual Air Vents: Manual air vents shall be brass or bronze valves or cocks suitable for the pressure rating of the piping system and furnished with threaded plugs or caps.

2. Automatic Air Vents: Automatic air vents shall be 3/4 inch quick-venting float and vacuum air valves. Each air vent valve shall have a large port permitting the expulsion of the air without developing excessive back pressure, a noncollapsible metal float which will close the valve and prevent the loss of water from the system, an air seal that will effectively close and prevent the re-entry of air into the system when subatmospheric pressures prevail therein, and a thermostatic member that will close the port against the passage of steam from the system. The name of the manufacturer shall be clearly stamped on the outside of each valve. The air vent valve shall be suitable for the pressure rating of the piping system.

2.8 ELECTRICAL EQUIPMENT

Electric motor-driven equipment shall be provided complete with motors, motor starters, and necessary control devices. Electrical equipment, motor control devices, motor efficiencies and wiring shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Motors which are not an integral part of a packaged boiler shall be rated for high efficiency service. Motors which are an integral part of the packaged boiler shall be the highest efficiency available by the manufacturer of the packaged boiler. Motor starters shall be provided complete with properly sized thermal overload protections and other appurtenances necessary for the motor control specified. Starters shall be furnished in general purpose enclosures. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices but not shown shall be provided.

A. Motor Ratings: Motors shall be suitable for the voltage and frequency provided. Motors 1/2 hp and larger shall be three-phase, unless otherwise indicated. Motors shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor.

B. Motor Controls: Motor controllers shall be provided complete with properly sized thermal overload protection. Manual or automatic control and protective or signal devices required for the operation specified and any wiring required to such devices shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Solid state variable speed controllers shall be utilized for fractional through 10 hp ratings. Adjustable frequency drives shall be used for larger motors.

2.9 INSULATION

A. Shop and field-applied insulation shall be as specified in Section 15280 EQUIPMENT INSULATION

2.10 TOOLS

Special tools shall be furnished. Special tools shall include uncommon tools necessary for the operation and maintenance of boilers, burners, pumps, fans, controls, meters, special piping systems, and other equipment. Small hand tools shall be furnished within a suitable cabinet, mounted where directed.

A. Breeching Cleaner: A cleaner shall be provided to clean the breeching. The cleaner shall have a jointed handle of sufficient length to clean the breeching without dismantling.

B. Wrenches: Wrenches shall be provided as required for specialty fittings such as manholes, handholes, and cleanouts. One set of extra gaskets shall be provided for all manholes and handholes, for pump barrels, and other similar items of equipment. Gaskets shall be packaged and properly identified.

PART 3 - EXECUTION

3.1 ERECTION OF BOILER AND AUXILIARY EQUIPMENT

A. Boiler and auxiliary equipment shall be installed in accordance with manufacturer's written instructions.

B. Cold Water Connections: Cold water fill connections shall be made to the water supply system as indicated. Necessary pipe, fittings, and valves required for water connections between the boiler and cold water main shall be provided as shown. The pressure regulating valve shall be of a type that will not stick or allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure of approximately 5 psi in excess of the static head on the system and shall operate within a 2 psi tolerance regardless of cold water supply piping pressure and without objectionable noise under any condition of operation.

C. Gauge Piping: Piping shall be copper tubing.

D. Hot Water Connections to Equipment: Hot water supply and return connections shall be provided as shown. Connections shall be made with malleable-iron unions or with steel flanges, to match equipment. Valves and traps shall be installed in accordance with the manufacturer's recommendations. The size of the supply and return pipes to each piece of equipment shall not be smaller than the outlets on the equipment.

E. Hot Water Risers: The location of risers is approximate. The exact locations of the risers shall be approved.

F. Air Vents for System: Automatic balanced pressure thermostatic air vents shall be installed at the ends of the lines and where shown on the drawings. The vents shall be rated for 125 psi service. The outlet

of the vent shall be routed to a point designated by the Contracting Officer's Representative. The inlet line shall have a gate valve or ball valve.

G. Supports

1. General: Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers.

2. Seismic Requirements for Supports and Structural Bracing: Piping and attached valves shall be supported and braced to resist seismic loads as specified in Section 15245 VIBRATION ISOLATION. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided in this section. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

H. Air Vents: Air vents shall be installed where shown or directed. Air vents shall be installed in piping at all system high points. The vent shall remain open until water rises in the tank or pipe to a predetermined level at which time it shall close tight. An overflow pipe from the vent shall be run to a point designated by the Contracting Officer's representative. The inlet to the air vent shall have a gate valve or ball valve.

I. Escutcheons: Escutcheons shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrews.

3.2 FIELD PAINTING

A. Ferrous metal not specified to be coated at the factory shall be cleaned, prepared, and painted as specified in

Section 09900 PAINTING. Exposed pipe covering shall be painted as specified in Section 09900PAINTING. Aluminum sheath over insulation shall not be painted.

3.3 HEATING SYSTEM TESTS

A. Before any covering is installed on pipe or heating equipment, the entire heating system's piping, fittings, and terminal heating units shall be hydrostatically tested and proved tight at a pressure of 1-1/2 times the design working pressure. Before pressurizing system for test, items or equipment (e.g., vessels, pumps, instruments, controls, relief valves) rated for pressures below the test pressure shall be blanked off or replaced with spool pieces. Before balancing and final operating test, test blanks and spool pieces shall be removed; and protected instruments and equipment shall be reconnected. With equipment items protected, the system shall be pressurized to test pressure. Pressure shall be held for a period of time sufficient to inspect all welds, joints, and connections for leaks, but not less than 2 hours. No loss of pressure will be allowed. Leaks shall be repaired and repaired joints shall be retested. Caulking of joints shall not be permitted. System shall be drained and after instruments and equipment are reconnected, the system shall be refilled with service medium and maximum operating pressure applied. The pressure shall be held while inspecting these joints and connections for leaks. The leaks shall be repaired and the repaired joints retested. Upon completion of hydrostatic tests and before acceptance of the installation, the Contractor shall balance the heating system in accordance with Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS; and operating tests required to demonstrate satisfactory functional and operational efficiency shall be performed. The operating test shall cover a period of at least 24 hours for each system, and shall include, as a minimum, the following specific information in a report, together with conclusions as to the adequacy of the system:

a. Certification of balancing.

b. Time, date, and duration of test.

c. Outside and inside dry bulb temperatures.

d. Hot water pressure.

e. Temperature of condensate feed to boiler inlet.

f. Quantity of water feed to boiler.

g. Boiler make, type, serial number, design pressure, and rated capacity.

h. Fuel burner make, model, and rated capacity; ammeter and voltmeter readings for burner motor.

i. Condensate and Boiler Feed Pump: pump make, model, and rated capacity, and ammeter and voltmeter readings for pump motor during operation.

j. Flue-gas temperature at boiler outlet.

k. Percent carbon dioxide in flue-gas.

l. Grade or type and calorific value of fuel.

m. Draft at boiler flue-gas exit.

n. Draft or pressure in furnace.

o. Quantity of fuel consumed.

p. Stack emission pollutants concentration.

Indicating instruments shall be read at half-hour intervals unless otherwise directed. The Contractor shall furnish all instruments, equipment, and personnel required for the tests and balancing. Operating tests shall demonstrate that fuel burners and combustion and safety controls meet the requirements of ASME CSD-1, ANSI Z21.13, NFPA 8501 and NFPA 85C.

1. Boiler/Piping Test: At the conclusion of the 1 year period, the boiler and condensate piping shall be inspected for problems due to corrosion and scale. If the boiler is found not to conform to the manufacturer's recommendations, and the water treatment company recommendations have been followed, the water treatment company shall provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations. If corrosion is found within the condensate piping, proper repairs shall be made by the water treatment company.

3.4 CLEANING

A. Boilers and Piping: After the hydrostatic tests have

been made and before the system is balanced and operating tests are performed, the boilers and feed water piping shall be thoroughly cleaned by filling the system with a solution consisting of either 1 pound of caustic soda or 1 pound of trisodium phosphate per 50 gallons of water. The proper safety precautions shall be observed in the handling and use of these chemicals. The water shall be heated to approximately 150 degrees F and the solution circulated in the system for a period of 48 hours. The system shall then be drained and thoroughly flushed out with fresh water. Strainers and valves shall be thoroughly cleaned. Prior to operating tests, air shall be removed from all water systems by operating the air vents.

3.5 FIELD TRAINING

A. Provide under provisions of 15010.

END OF SECTION

SECTION 15575

BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated breechings.

B. Manufactured chimneys for gas fired equipment.

C. Vent dampers.

D. Manufactured double wall chimneys for fuel fired equipment.

E. Induced draft fans.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15170 - Motors: Inducer draft fan motor.

C. Section 15280 - Equipment Insulation: Breeching insulation.

D. Section 15569 - Water Heating, Gas.

E. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

F. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. ANSI Z21.66 - Electrically Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.

B. ANSI Z21.67 - Mechanically Actuated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.

C. ANSI Z21.68 - Thermally Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.

D. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

E. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.

F. ASTM A527 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.

G. ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent) Hot-Rolled Commercial Quality.

H. NEMA MG1 - Motors and Generators.

I. NFPA 31 (ANSI Z95.1) - Standard for the Installation of Oil Burning Equipment.

J. NFPA 54 (ANSI Z223.1) - The National Fuel Gas Code.

K. NFPA 70 - National Electrical Code.

L. NFPA 82 - Standard on Incinerators, Waste, and Linen Handling Systems and Equipment.

M. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.

N. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

O. UL 103 - Standard for Factory Built Low Heat Chimneys.

P. UL 127 - Standard for Factory Built Fireplaces.

Q. UL 378 - Standard for Draft Equipment.

R. UL 441 - Standard for Gas Vents.

S. UL 641 - Standard for Low Temperature Venting Systems.

T. UL 959 (ANSI Z181.1) - Medium Heat Appliance Factory Built Chimneys.

U. AWS D91. - Specifications For Welding Sheet Metal.

1.4 DEFINITIONS

A. Breeching: Vent Connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Smoke Pipe: Round, single wall vent connector.

D. Vent: That portion of a venting system designed to convey

flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

E. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.5 DESIGN REQUIREMENTS

A. Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.

1.6 SUBMITTALS: Section 01300 - Submittals: Procedures for submittals and Section 15010.

A. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory built units are used.

B. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

C. Installation Instructions: Submit manufacturer's installation instructions: Indicate assembly, support details, and connection requirements.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

C. Design stacks under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of New Hampshire.

1.8 REGULATORY REQUIREMENTS

A. Conform to NFPA 54 (ANSI Z223.1) code for installation of natural gas burning appliances and equipment.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as

suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 BREECHING

A. Fabricate of ASTM A569 carbon steel. Fabricate breechings less than 24 inch (610 mm) diameter of ASTM A527 galvanized sheet steel, lock forming quality with ASTM A525 G90 zinc coating.

B. Fabricate breechings from following minimum gages. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
   1. Sizes up to 12 inches (305 mm): 18 gage (1.3 mm).
   2. Sizes 13 to 24 inches (330 to 610 mm): 16 gage (1.6 mm).
   3. Sizes 25 to 36 inches (635 to 914 mm): 14 gage (2.0 mm).
   4. Sizes 37 to 60 inches (940 to 1524 mm): 12 gage (2.8 mm).

C. Provide adjustable self-actuating barometric draft dampers, where required by manufacturer, full size of breeching.

D. Provide cleanout doors of same gage as breeching.

E. Weld longitudinal seams. Fabricate joints by welding, lapping and bolting, or with companion flanges. For breechings less than 24 inches (610 mm) diameter provide groove seam (pipe lock or flat lock) with end joints beaded and crimped.

F. Reinforce rectangular breeching with angle frames and round breeching with flanged girth joints or angle frames. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

   1. Sizes up to 30 inches (762 mm): No reinforcing required.
   2. Sizes 31 to 36 inches (782 to 914 mm): 1-1/2 x 1-1/2 x 3/16 inches (38 x 38 x 5 mm), at 60 inch (1524 mm) centers.
   3. Sizes 37 to 60 inches (940 to 1524 mm): 2 x 2 x 1/4 inch (51 x 51 x 6 mm), at 60 inch (1524 mm) centers.
   4. Sizes over 60 inches (1524 mm): 3 x 3 x 1/2 inch (76 x 76 x 13 mm), at 60 inch (1524 mm) centers.

G. Fabricate breeching fittings to match adjoining breechings. Fabricate elbows with center-line radius equal

to breeching diameter. Limit angular tapers to 20 degrees maximum.

2.2 DOUBLE WALL METAL STACKS

A. Acceptable Manufacturers:

1. Van-Packer Co.
2. Selkirk Metalbestos
3. American Metal Products

B. Provide double wall metal stacks, tested to UL 103 and UL listed, for use with building heating equipment, in compliance with NFPA 211.

C. Fabricate with 1 inch (25 mm) minimum air space between walls. Construct inner jacket of 20 gage (0.9 mm) ASTM A167 Type 304 stainless steel. Construct outer jacket of Type 304 stainless steel 24 gage (0.6 mm) for sizes 10 inches to 24 inches (254 mm to 610 mm) and 20 gage (0.9 mm) for sizes 28 inches to 48 inches (711 mm to 1219 mm).

D. Accessories, UL labeled:

1. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.
2. Exit Cone: Consists of inner cone, and outer jacket, to increase stack exit velocity 1.5 times.
3. Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 54 (ANSI Z223.1).

C. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

D. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot (3.7 m) spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and

size.

E. Install concrete inserts for support of breechings, chimneys, and stacks in coordination with formwork.

F. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

G. Coordinate installation of dampers, and induced draft fans. Refer to Section 16180.

H. Insulate breechings in accordance with Section 15280.

I. For double wall metal stacks, maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories as required for complete installation.

J. Install vent dampers, locating close to draft hood collar, and secured to breeching.

K. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement to ASTM C105. Connect base section to foundation using anchor lugs.

L. Level and plumb chimney and stacks.

M. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

N. At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, breeching insulation, chimneys, or stacks.

O. Provide stack continuously from appliances.

3.2 SCHEDULES

A.

EQUIPMENT	BREECHING	CHIMNEY/STACK
Boiler	Steel	Type B

END OF SECTION

SECTION 15653

AIR-CONDITIONING SYSTEM (UNITARY TYPE)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 700	(1993) Specifications for Fluorocarbon and Other Refrigerants
ARI 710	(1986) Liquid-Line Driers
ARI 720	(1988) Refrigerant Access Valves and Hose Connectors
ARI 750	(1987) Thermostatic Refrigerant Expansion Valves
ARI 760	(1987) Solenoid Valves for Use with Volatile Refrigerants

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500	(1989) Test Methods for Louvers, Dampers and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 334	(1991) Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM B 280	(1993a) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM C 534	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 1071	(1991) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
ASTM D 520	(1984; R 1989) Zinc Dust Pigment

ASTM E 437	(1992) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM F 104	(1993) Nonmetallic Gasket Materials

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15	(1994) Safety Code for Mechanical Refrigeration
ASHRAE 34	(1994) Number Designation and Safety Classification of Refrigerants
ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B31.1	(1992; B31.1a; B31.1b; B31.1c) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME BPV VIII Div 1	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1993; Rev 1-1993) Motors and Generators
NEMA MG 2	(1989; Rev 1) Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

SMACNA-06	(1995) HVAC Duct Construction Standards -

Metal and Flexible

UNDERWRITERS LABORATORIES (UL)

UL 586	(1990; Rev Apr 1995) High Efficiency, Particulate, Air Filter Units
UL 900	(1994) Test Performance of Air Filter Units
UL 1995	(1995) Heating and Cooling Equipment

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Air-Conditioning/Gas Heat System; GA.

Manufacturer's standard catalog data, prior to the purchase or installation of a particular component, shall be highlighted to show brand name, model number, size, options, performance charts and curves, etc. in sufficient detail to demonstrate compliance with contract requirements. Data shall be submitted for each specified component. Data shall include manufacturer's recommended installation instructions and procedures. If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

Spare Parts Data; GA.

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

SD-04 Drawings

Air-Conditioning; GA.

Drawings shall provide adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

(1) Equipment layouts which identify assembly and installation details.

(2) Piping layouts which identify valves and fittings.

(3) Plans and elevations which identify clearances required for maintenance and operation.

(4) Wiring diagrams which identify each component individually and interconnected or interlocked relationships between components.

(5) Foundation drawings, bolt-setting information, and foundation bolts prior to concrete foundation construction for equipment indicated or required to have concrete foundations.

(6) Details, if piping and equipment are to be supported other than

as indicated, which include loadings and type of frames, brackets, stanchions, or other supports.

(7) Automatic temperature control diagrams and control sequences.

(8) Installation details which includes the amount of factory set superheat and corresponding refrigerant pressure/temperature.

SD-06 Instructions

Framed Instructions; FIO.

Framed instructions for posting, at least 2 weeks prior to construction completion.

SD-07 Schedules

Tests; FIO.

A letter, at least 10 working days in advance of each tests, advising the Contracting Officer of the test. Individual letters shall be submitted for the condenser water system, refrigerant system, ductwork leak tests, cooling tower tests, condenser water quality tests, and the system performance tests. Each letter shall identify the date, time, and location for each test.

Demonstrations; GA.

A letter, at least 14 working days prior to the date of the proposed training course, which identifies the date, time, and location for the training.

SD-08 Statements

Qualifications; GA.

A letter listing the qualifying procedures for each welder. The letter shall include supporting data such as test procedures used, what was tested etc., and a list of the names of qualified welders and their identification symbols.

Verification of Dimensions; FIO.

A letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

SD-09 Reports

Tests; GA.

Six copies of each test containing the information described below in bound 8-1/2 by 11 inchbooklets. Individual reports shall be submitted for the condenser water system, refrigerant system, ductwork leak tests, and the cooling tower tests.

(1) The date the tests were performed.

(2) A list of equipment used, with calibration certifications.

(3) Initial test summaries.

(4) Repairs/adjustments performed.

(5) Final test results.

System Performance Tests; GA.

Six copies of the report shall be provided in bound 8-1/2 by 11 inch booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart:

(1) Date and outside weather conditions.

(2) The load on the system based on the following:
(a) The refrigerant used in the system.
(b) Condensing temperature and pressure.
(c) Suction temperature and pressure.
(d) Ambient, condensing and coolant temperatures
(e) Running current, voltage and proper phase sequence for each phase of all motors.

(3) The actual on-site setting of operating and safety controls.

(4) Thermostatic expansion valve superheat - value as determined by field test

(5) Subcooling

(6) High and low refrigerant temperature switch set-points

(7) Low oil pressure switch set-point

(8) Defrost system timer and thermostat set-points

(9) Moisture content

(10) Capacity control set-points

(11) Field data and adjustments which affect unit performance and energy consumption.

(12) Field adjustments and settings which were not permanently marked as an integral part of a device.

Inspections; GA.

Test report, at the completion of one year of service, in bound 8-1/2 by 11 inch booklets. The report shall identify the condition of the cooling tower and condenser. The report shall also include a comparison of the condition of the cooling tower and condenser with the manufacturer's recommended operating conditions.

SD-13 Certificates

Air-Conditioning; GA.

Where the system, components, or equipment are specified to comply with requirements of ARI, ASHRAE, ASME, or UL, proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or

other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

Service Organizations; GA.

A certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

SD-19 Operation and Maintenance Manuals

Operation Manual; GA.

Six complete copies of an operation manual in bound 8-1/2 by 11 inch booklets listing step-by-step procedures required for system startup, operation, and shutdown. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manual; GA.

Six complete copies of maintenance manual in bound 8-1/2 by 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

1.3 QUALIFICATIONS

Piping shall be welded in accordance with the qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL.

1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather and contamination. Proper protection and care of all material before, during, and after installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.5.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions. Equipment, ductwork, and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be environmentally suitable for the indicated locations.

2.2 NAMEPLATES

Major equipment including compressors, condensers, receivers, heat exchanges, fans, cooling towers, pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life and made of anodized aluminum. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and

devices specified, but not shown, shall be provided.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Gaskets

Gaskets shall conform to ASTM F 104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 700 degrees F service.

2.4.2 Bolts and Nuts

Bolts and nuts, except as required for piping applications, shall be in accordance with ASTM A 307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A 307.

2.4.3 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.4.4 NOT USED

2.4.5 NOT USED

2.4.6 NOT USED

2.4.7 Unicellular Plastic Foam

Unicellular plastic foam shall be in accordance with ASTM C 534, Form T, except that D-Factor shall not exceed 0.28 at 75 degrees F mean temperature.

2.4.8 Bird Screen

Screen shall be in accordance with ASTM E 437, Type 1, Class 1, 2 by 2 mesh, 0.063 inch diameter aluminum wire or 0.031 inch diameter stainless steel wire.

2.5 NOT USED

2.6 UNITARY EQUIPMENT, PACKAGE SYSTEM

Unit shall be an air-cooled factory assembled, weatherproof packaged unit as indicated. Unit shall be the refrigerant air-conditioning type conforming to applicable Underwriters Laboratories (UL) standards including UL 1995. Unit shall be provided with equipment as specified in paragraph "System Components". Evaporator or supply fans shall be double-width, double inlet, forward curved, backward inclined, or airfoil blade, centrifugal scroll type. Motors shall have dripproof enclosures. Condenser fans shall be manufacturer's standard for the unit specified and may be either propeller or centrifugal scroll type. Unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged with refrigerant and oil in accordance with manufacturer's recommendations.

2.6.1 Air-to-Refrigerant Coils

Air-to-refrigerant coils shall have nonferrous tubes of 3/8 inch minimum diameter with copper or aluminum fins that are mechanically bonded or soldered to the tubes. Coils shall be protected with a minimum 3 milthick phenolic or vinyl coating. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be

provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged. Separate expansion devices shall be provided for each compressor circuit.

2.6.2 NOT USED

2.6.3 NOT USED

2.6.4 Compressor

Compressor shall be direct drive, semi-hermetic or hermetic reciprocating, or scroll type capable of operating at partial load conditions. Compressor shall be capable of continuous operation down to the lowest step of unloading as specified. Compressors of 10 tons and larger shall be provided with capacity reduction devices to produce automatic capacity reduction of at least 50 percent. If standard with the manufacturer, two or more compressors may be used in lieu of a single compressor with unloading capabilities, in which case the compressors shall operate in sequence, and each compressor shall have an independent refrigeration circuit through the condenser and evaporator. Compressors shall start in the unloaded position. Each compressor shall be provided with vibration isolators, crankcase heater, thermal overloads, high and low pressure safety cutoffs and protection against short cycling.

2.6.5 Refrigeration Circuit

Refrigerant containing components shall comply with ASHRAE 15 and be factory tested, cleaned, dehydrated, charged, and sealed. Refrigerant charging valves and connections, and pumpdown valves shall be provided for each circuit. Filter-drier shall be provided in each liquid line and be reversible-flow type. Refrigerant flow control devices shall be an adjustable superheat thermostatic expansion valve with external equalizer matched to coil, capillary or thermostatic control, and a pilot solenoid controlled, leak-tight, four-way refrigerant flow reversing valve.

2.6.6 Unit Controls

Unit shall be internally prewired with a 120-Volt control circuit powered by an internal transformer. Terminal blocks shall be provided for power wiring and external control working. Unit shall have cutoffs for high and low pressure, and low oil pressure for compressors with positive displacement oil pumps, supply fan failure and safety interlocks on all service panels. Head pressure controls shall sustain unit operation with ambient temperature of 0 deg. F. Adjustable-cycle timers shall prevent short-cycling. Multiple compressors shall be staged by means of a time delay. Unit shall be internally protected by fuses or a circuit breaker in accordance with UL 1995. Low cost cooling shall be made possible by means of a control circuit which will modulate dampers to provide 100 percent outside air while locking out compressors.

2.7 NOT USED

2.8 NOT USED

2.9 EQUIPMENT EFFICIENCY

EER = 11.0.

2.10 NOT USED

2.11 NOT USED

2.12 SYSTEM COMPONENTS

2.12.1 Refrigerant and Oil

Refrigerant shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ASHRAE 34. Refrigerants shall meet the requirements of ARI 700 as a minimum. Refrigerants shall have an Ozone Depletion Potential (ODP) of less than or equal to 0.05. Contractor shall provide and install a complete charge of refrigerant for the installed system as recommended by the manufacturer. Except for factory sealed units, two complete charges of lubricating oil for each compressor crankcase shall be furnished. One charge shall be used during the system performance testing period. Following the satisfactory completion of the performance testing, the oil shall be drained and replaced with a second charge. Lubricating oil shall be of a type and grade recommended by the manufacturer for each compressor. Where color leak indicator dye is incorporated, charge shall be in accordance with manufacturer's recommendation.

2.12.2 Fans

Fan wheel shafts shall be supported by either maintenance-accessible lubricated antifriction block-type bearings, or permanently lubricated ball bearings. Unit fans shall be selected to produce the cfm required at the fan total pressure. Motor starters, if applicable, shall be magnetic across-the-line type with a dripproof enclosure. Thermal overload protection shall be of the manual or automatic-reset type. Fan wheels or propellers shall be constructed of aluminum or galvanized steel. Centrifugal fan wheel housings shall be of galvanized steel, and both centrifugal and propeller fan casings shall be constructed of aluminum or galvanized steel. Steel elements of fans, except fan shafts, shall be hot-dipped galvanized after fabrication or fabricated of mill galvanized steel. Mill-galvanized steel surfaces and edges damaged or cut during fabrication by forming, punching, drilling, welding, or cutting shall be recoated with an approved zinc-rich compound. Fan wheels or propellers shall be statically and dynamically balanced. Direct-drive fan motors shall be of the multiple-speed variety. Belt-driven fans shall have adjustable sheaves. The sheave size shall be selected so that the fan speed at the approximate midpoint of the sheave adjustment will produce the specified air quantity. Centrifugal scroll-type fans shall be provided with streamlined orifice inlet and V-belt drive. Each drive will be independent of any other drive. Propeller fans shall be direct-drive drive type with fixed pitch blades. V-belt driven fans shall be mounted on a corrosion protected drive shaft supported by either maintenance-accessible lubricated antifriction block-type bearings, or permanently lubricated ball bearings. Each drive will be independent of any other drive. Drive bearings shall be protected with water slingers or shields. V-belt drives shall be fitted with guards where exposed to contact by personnel and adjustable pitch sheaves.

2.12.3 NOT USED

2.12.4 Air Filters

Air filters shall be listed in accordance with requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test Method shall be as listed under the label service and shall meet the requirements of UL 586.

2.12.4.1 NOT USED

2.12.4.2 Replaceable Media Filters

Replaceable media filters shall be the dry-media type, of the size required to suit the application. Filtering media shall be not less than 2 inches thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Pad shall be enclosed in a holding frame of not less than 16 gauge galvanized steel, and equipped with quick-opening mechanism for

changing filter media. The air flow capacity of the filter shall be based on net filter face velocity not exceeding 300 (1.52 m/s) feet per minute, with initial resistance of 0.13 (32 Pa) inches water gauge. Average efficiency shall be not less than 30 percent when tested in accordance with ASHRAE 52.1.

2.12.5 NOT USED

2.12.6 NOT USED

2.12.7 Internal Dampers

Dampers shall be parallel blade type with renewable blade seals and be integral to the unitary unit. Damper provisions shall be provided for each outside air intake, exhaust, economizer, and mixing boxes. Dampers shall have automatic modulation and operate as specified.

2.12.8 NOT USED

2.12.9 Cabinet Construction

Casings for the specified unitary equipment shall be constructed of galvanized steel or aluminum sheet metal and galvanized or aluminum structural members. Minimum thickness of single wall exterior surfaces shall be 18 gauge galvanized steel or 071 inch thick aluminum on units with a capacity above 20 tons and 20 gauge galvanized steel or 0.064 inch thick aluminum on units with a capacity less than 20 tons. Casing shall be fitted with lifting provisions, access panels or doors, fan vibration isolators, electrical control panel, corrosion-resistant components, structural support members, insulated condensate drip pan and drain, and internal insulation in the cold section of the casing. Where double-wall insulated construction is proposed, minimum exterior galvanized sheet metal thickness shall be 20 gauge. Provisions to permit replacement of major unit components shall be incorporated. Penetrations of cabinet surfaces, including the floor, shall be sealed. Unit shall be fitted with a drain pan which extends under all areas where water may accumulate. Drain pan shall be fabricated from Type 300 stainless steel, galvanized steel with protective coating as required, or an approved plastic material. Pan insulation shall be water impervious. Extent and effectiveness of the insulation of unit air containment surfaces shall prevent, within limits of the specified insulation, heat transfer between the unit exterior and ambient air, heat transfer between the two conditioned air streams, and condensation on surfaces. Insulation shall conform to ASTM C 1071. Paint and finishes shall comply with the requirements specified in paragraph "Factory Coating".

2.12.9.1 Indoor Cabinet

Indoor cabinets shall be suitable for the specified indoor service and enclose all unit components.

2.12.9.2 Outdoor Cabinet

Outdoor cabinets shall be suitable for outdoor service with a weathertight, insulated and corrosion-protected structure. Cabinets constructed exclusively for indoor service which have been modified for outdoor service are not acceptable.

2.13 NOT USED

2.14 NOT USED

2.15 NOT USED

2.16 NOT USED

2.17 NOT USED

2.18 NOT USED

2.19 NOT USED

2.20 NOT USED

2.21 INSULATION

2.21.1 NOT USED

2.21.2 Factory Installed Insulation

Factory applied insulation shall be as specified for the equipment to be insulated except that refrigerant suction lines shall be insulated with unicellular plastic foam. Insulation shall comply with the fire hazard rating specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.22 NOT USED

2.23 NOT USED

2.24 NOT USED

2.24.1 NOT USED

2.24.2 NOT USED

2.24.3 NOT USED

2.24.4 NOT USED

2.24.5 NOT USED

2.24.6 NOT USED

2.24.7 NOT USED

2.24.8 Louvers

Louvers shall be furnished for installation in exterior walls which are directly connected by ductwork to air handling equipment. Louver blades shall be fabricated from anodized aluminum or galvanized steel sheets, and shall be provided with a frame of galvanized steel or aluminum structural shapes. Sheet metal thickness and fabrication shall conform to SMACNA-06. Blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Louver shall be provided with bird screen. Louvers shall bear AMCA Certified Ratings Seal for air performance and water penetration ratings as described in AMCA 500.

2.25 NOT USED

2.26 REFRIGERANT PIPING

Refrigerant piping, valves, fittings, and accessories shall conform to the requirements of ASHRAE 15 and ASME B31.5, except as specified.

2.26.1 Steel Pipe

Steel pipe for refrigerant service shall conform to ASTM A 53, Schedule 40, Type E or S, Grades A or B. Type F pipe shall not be used.

2.26.2 Joints and Fittings, Steel Pipe

Joints and fittings shall be steel butt-welding, socket-welding, or malleable iron threaded type. Pipe shall be welded except that joints on lines 2 inches and smaller may be threaded. Threads shall be tapered type conforming to ASME B1.20.1. The malleable iron threaded type fitting shall be of a weight corresponding to adjacent pipe. Flanges and flange faces of fittings shall be tongue-and-groove type with gaskets suitable for the refrigerant used; size 1 inch and smaller shall be oval, two-bolt type; size above 1 inch, up to and including 4 inches, shall be square four-bolt type; and sizes over 4 inches shall be round.

2.26.3 Steel Tubing

Steel tubing for refrigeration service shall be in accordance with ASTM A 334, Grade 1. Tubing with a nominal diameter of 3/8 inch or 1/2 inch shall have a wall thickness of 0.049 inches. Tubing with a nominal diameter of 3/4 inch through 2 inches shall have a wall thickness of 0.065 inches. Tubing with a nominal diameter of 2 1/2 inches through 4 inches shall have a wall thickness of 0.095 inches. Steel tubing shall be cold-rolled, electric-forged, welded-steel. One end of the tubing shall be provided with a socket. Steel tubing shall be cleaned, dehydrated, and capped.

2.26.4 Joints and Fittings, Steel Tubing

Joints and fittings shall be socket type provided by the steel tubing manufacturer.

2.26.5 Copper Tubing

Copper tubing shall conform to ASTM B 280 annealed or hard drawn as required. Copper tubing shall be soft annealed where bending is required and hard drawn where no bending is required. Soft annealed copper tubing shall not be used in sizes larger than 1-3/8 inches. Joints shall be brazed except that joints on lines 7/8 inch and smaller may be flared.

2.26.6 Joints and Fittings, Copper Tubing

Copper tube joints and fittings shall be flare joint type with short-shank flare, or solder-joint pressure type. Joints and fittings for brazed joint shall be wrought-copper or forged-brass sweat fittings. Cast sweat-type joints and fittings shall not be allowed for brazed joints.

2.26.7 Valves

Valves shall be pressure and temperature rated for contained refrigerant service and shall comply with ASME B31.5. Metals of construction shall be ferrous or copper based. Atmosphere exposed valve stems shall be stainless steel or corrosion resistant metal plated carbon steel. Valve body connections shall be brazed or welded socket, flanged or combination thereof. Threaded connections shall not be used, except in pilot pressure or gauge lines where maintenance disassembly is required and welded flanges cannot be used. Valves shall be suitable for or fitted with extended copper ends for brazing in-place without disassembly. Ferrous body valves shall be fitted with factory fabricated and brazed copper transitions. To minimize system pressure drops, where practicable, globe valves shall be angle body type, and straight line valves shall be full port ball type. Control valve inlets shall be fitted with integral or adapted strainer or filter where recommended or required by manufacturer. Valves shall be cleaned and sealed moisture-tight.

2.26.7.1 Refrigerant-Stop Valves

Valves, in sizes through 5/8 inch, shall be handwheel operated, straight

or angle, packless diaphragm globe type with back-seating stem, brazed ends, except where SAE flare or retained seal cap connections are required. In sizes over 5/8 inch, valves shall be globe or angle type, wrench operated with ground-finish stems, or ball valves, packed especially for refrigerant service, back seated, and provided with seal caps. Refrigerant isolation and shut-off valves shall have retained or captive spindles and facilities for tightening or replacement of the gland packing under line pressure as applicable. Stop valves shall have back-seating plated steel stem, bolted bonnet in sizes 1-1/8 inches OD and larger, integral or flanged transition brazed socket. Valves in sizes through 2-1/2 inches shall be end-entry body assembly, full-port, floating ball type, with equalizing orifice fitted chrome plated ball, seats and seals of tetrafluoroethylene, chrome plated or stainless steel stem, and seal cap. In sizes 4 inch IPS and larger, and in smaller sizes where carbon steel piping is used, valve bodies shall be tongue and groove flanged and complete with mating flange, gaskets and bolting for socket or butt-weld connection. Purge, charge and receiver valves shall be of manufacturer's standard configuration.

2.26.7.2 NOT USED

2.26.7.3 Liquid Solenoid Valves

Valves shall comply with ARI 760 and be suitable for continuous duty with applied voltages 15 percent under and 5 percent over nominal rated voltage at maximum and minimum encountered pressure and temperature service conditions. Valves shall be direct-acting or pilot-operating type, packless, except that packed stem, seal capped, manual lifting provisions shall be furnished. Solenoid coils shall be moisture-proof, UL approved, totally encapsulated or encapsulated and metal jacketed as required. Valves shall have safe working pressure of 400 psi and a maximum operating pressure differential of at least 200 psi at 85 percent rated voltage. Valves shall have an operating pressure differential suitable for the refrigerant used.

2.26.7.4 Expansion Valves

Expansion valves conform to requirements of ARI 750. Valve shall be of the diaphragm and spring type with internal or external equalizers, and bulb and capillary tubing. Valve shall be provided with an external superheat adjustment along with a seal cap. Internal equalizers may be utilized where flowing refrigerant pressure drop between outlet of the valve and inlet to the evaporator coil is negligible and pressure drop across the evaporator is less than the pressure difference corresponding to 2 degrees F of saturated suction temperature at evaporator conditions. Bulb charge shall be determined by the manufacturer for the application and such that liquid will remain in the bulb at all operating conditions. Gas limited liquid charged valves and other valve devices for limiting evaporator pressure shall not be used without a distributor or discharge tube or effective means to prevent loss of control when bulb becomes warmer than valve body. Pilot-operated valves shall have a characterized plug to provide required modulating control. A de-energized solenoid valve may be used in the pilot line to close the main valve in lieu of a solenoid valve in the main liquid line. An isolatable pressure gauge shall be provided in the pilot line, at the main valve. Automatic pressure reducing or constant pressure regulating expansion valves may be used only where indicated or for constant evaporator loads.

2.26.7.5 Safety Relief Valve

Valve shall be the two-way type. Single type valves shall be used only where indicated. Valve shall bear the ASME code symbol. Valve capacity shall be certified by the National Board of Boiler and Pressure Vessel Inspectors. Valve shall be of an automatically reseating design after activation.

2.26.7.6 Evaporator Pressure Regulators, Direct-Acting

Valve shall include a diaphragm/spring power assembly, external pressure adjustment with seal cap, and pressure gauge port. Valve shall maintain a constant inlet pressure by balancing inlet pressure on diaphragm against an adjustable spring load. Pressure drop at system design load shall not exceed the pressure difference corresponding to a 2 degrees F change in saturated refrigerant temperature at evaporator operating suction temperature. Spring shall be selected for indicated maximum allowable suction pressure range.

2.26.7.7 Refrigerant Access Valves

Refrigerant access valves and hose connections shall be in accordance with ARI 720.

2.26.8 Accessories

2.26.9 Filter Driers

Driers shall conform to ARI 710. Sizes 5/8 inch and larger shall be the full flow, replaceable core type. Sizes 1/2 inch and smaller shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down, and shall remove water, acid, and foreign material from the refrigerant. Filter driers shall be constructed so that none of the desiccant will pass into the refrigerant lines. Minimum bursting pressure shall be 1,500 psi.

2.26.9.1 Sight Glass and Liquid Level Indicator

a. Assembly and Components: Assembly shall be pressure- and temperature-rated and constructed of materials suitable for the service. Glass shall be borosilicate type. Ferrous components subject to condensation shall be electro-galvanized.

b. Gauge Glass: Gauge glass shall include top and bottom isolation valves fitted with automatic checks, and packing followers; red-line or green-line gauge glass; elastomer or polymer packing to suit the service; and gauge glass guard.

c. Bull's-Eye and Inline Sight Glass Reflex Lens: Bull's-eye and inline sight glass reflex lens shall be provided for dead-end liquid service. For pipe line mounting, two plain lenses in one body suitable for backlighted viewing shall be provided.

d. Moisture Indicator: Indicator shall be a self-reversible action, moisture reactive, color changing media. Indicator shall be furnished with full-color-printing tag containing color, moisture and temperature criteria. Unless otherwise indicated, the moisture indicator shall be an integral part of each corresponding sight glass.

2.26.9.2 Vibration Dampeners

Dampeners shall be of the all-metallic bellows and woven-wire type.

2.26.9.3 Flexible Pipe Connectors

Connector shall be pressure and temperature rated for the service in accordance with ASHRAE 15 and ASME B31.5. Connector shall be a composite of interior corrugated phosphor bronze or Type 300 Series Stainless steel, as required for fluid service, with exterior reinforcement of bronze, stainless steel or monel wire braid. Assembly shall be constructed with a safety factor of not less than 4 at 300 degrees F. Unless otherwise

indicated, the length of a flexible connector shall be as recommended by the manufacturer for the service intended.

2.26.9.4 Strainers

Strainers used in refrigerant service shall have brass or cast iron body, Y-or angle-pattern, cleanable, not less than 60-mesh noncorroding screen of an area to provide net free area not less than ten times the pipe diameter with pressure rating compatible with the refrigerant service. Screens shall be stainless steel or monel and reinforced spring-loaded where necessary for bypass-proof construction.

2.26.9.5 Brazing Materials

Brazing materials for refrigerant piping shall be in accordance with AWS A5.8, Classification BCuP-5.

2.27 DRAIN AND MISCELLANEOUS PIPING

Piping, fittings, valves and accessories for drain and miscellaneous services shall be in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

2.28 FABRICATION

2.28.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand [125] [500] hours exposure to the salt spray test specified in ASTM B 117 using a 25 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

2.28.2 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09900PAINTING, GENERAL.

2.28.2.1 Color Coding

Color coding for piping identification is specified in Section 09900 PAINTING, GENERAL.

2.28.2.2 Color Coding Scheme

A color coding scheme for locating hidden piping shall be in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPV VIII Div 1 and ASME BPV IX, the design, fabrication, and installation of the system shall conform to ASME BPV VIII Div 1 and ASME BPV IX.

3.1.1 Equipment

Refrigeration equipment and the installation thereof shall conform to ASHRAE 15. Necessary supports shall be provided for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, pumps, cooling towers, condensers, and similar items. Compressors shall be isolated from the building structure. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

3.1.2 NOT USED

3.1.3 NOT USED

3.1.4 NOT USED

3.1.5 NOT USED

3.1.6 NOT USED

3.1.7 NOT USED

3.1.8 NOT USED

3.1.9 NOT USED

3.1.10 NOT USED

3.1.11 NOT USED

3.1.12 NOT USED

3.1.13 NOT USED

3.1.14 NOT USED

3.1.15 NOT USED

3.1.16 NOT USED

3.1.17 Field Applied Insulation

Field applied insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.18 Factory Applied Insulation

Refrigerant suction lines between an evaporator and compressors shall be insulated with not less than 3/4 inch thick unicellular plastic foam.

3.1.19 Framed Instructions

Framed instructions shall be framed under glass or laminated plastic and be posted where directed. Instructions shall include equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The instructions shall be posted before acceptance testing of the system.

3.2 TESTS

Tests shall be conducted in the presence of the Contracting Officer. Utilities for testing shall be provided as specified in the SPECIAL CONTRACT REQUIREMENTS. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. The services of a qualified technician shall be provided as required to perform all tests and procedures indicated herein. Field tests shall be coordinated with Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.2.1 NOT USED

3.2.2 NOT USED

3.2.3 NOT USED

3.2.4 NOT USED

3.2.5 NOT USED

3.2.6 System Performance Tests

After the foregoing tests have been completed and before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 48 hours for each system and demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested.

3.3 INSPECTIONS

At the conclusion of the one year period, cooling towers and condensers shall be inspected for problems due to corrosion, scale, and biological growth. If the cooling tower and condenser are found not to conform to the manufacturers recommended conditions, assuming the water treatment company recommendations have been followed; the water treatment company shall provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations.

3.4 CLEANING AND ADJUSTING

3.4.1 Piping

Prior to testing, pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from each water system through the use of the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented.

3.4.2 Ductwork

Prior to testing, inside of ducts, plenums, and casing shall be thoroughly cleaned of all debris and blown free of small particles of rubbish and dust and then vacuum cleaned before installing outlet faces. Temporary filters shall be provided for fans that are operated during construction. New filters shall be installed after all construction dirt has been removed from the building and the ducts, plenum, casings, and other items specified have been vacuum cleaned. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.4.3 Equipment

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

3.4.4 Testing, Adjusting, and Balancing

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS.

3.5 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 4 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operation and maintenance manuals as well as demonstrations of routine maintenance operations.

-- End of Section --

SECTION 15682

AIR COOLED WATER CHILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Chiller package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Chilled water connections.

E. Starters.

F. Electrical power connections.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15170 - Motors

C. Section 15245 - Vibration Isolation.

D. Section 15510 - Hydronic Piping.

E. Section 15535 - Refrigeration Piping and Specialties.

F. Section 15540 - HVAC Pumps.

G. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

H. Section 15990 - Testing, Adjusting, and Balancing.

I. Section 16180 - Equipment Wiring Systems.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. ANSI/ARI 590 - Reciprocating Water - Chilling Packages.

B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code

E. ANSI/NEMA MG 1 - Motors and Generators.

F. ANSI/UL 465 - Central Cooling Air Conditioners.

G. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit shop drawings under provisions of Sections 01300 AND 15010.

A. Shop Drawings: Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate valves, strainers, and thermostatic valves required for complete system.

B. Product Data: Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Certification: Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturers requirements.

D. Installation Instructions: Submit manufacturer's installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operations data under provisions of Section 01000 and 15010.

B. Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.

C. Submit maintenance data under provisions of Sections 01000 and 15010.

1.6 REGULATORY REQUIREMENTS

A. Conform to ANSI/ARI 590 code for testing and rating of reciprocating water chillers.

B. Conform to ANSI/UL 465 code for construction of reciprocating water chillers and provide UL label.

C. Conform to ANSI/ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of reciprocating water chillers.

D. Conform to ANSI/ASHRAE 15 code for construction and operation of reciprocating water chillers.

E. Provide certification of inspection for conforming authority having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Sections 01000 and 15010.

B. Store and protect products under provisions of Sections 01000 and 15010.

C. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

D. Protect units on site from physical damage.

1.8 WARRANTY

A. Provide five year warranty under provisions of Sections 01000 and 15010.

B. Warranty: Include coverage for complete chiller package as manufactured and delivered to site including materials and labor.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of complete assembly for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Carrier Corp.

B. Dunham-Bush, Inc.

C. Snyder General Corp.

D. Trane Company

E. York International Corp.

2.2 MANUFACTURED UNITS

A. Provide factory assembled and tested outdoor air cooled liquid chillers consisting of reciprocating compressors, condenser, evaporator, thermal expansion valve,

refrigeration accessories, and control panel. Construction and ratings shall be in accordance with ANSI/ARI 590.

2.3 COMPRESSORS

A. Construct semi-hermetic reciprocating compressors with heat treated forged steel or ductile iron shafts, aluminum alloy connecting rods, automotive type pistons, rings to prevent gas leakage, suction and discharge valves, and sealing surface immersed in oil.

B. Statically and dynamically balance rotating parts. Refer to Section 15245.

C. Provide reversible, positive displacement, oil pump lubrication system with oil charging valve, oil level sight glass, oil filter, and magnetic plug on strainer, arranged to ensure adequate lubrication during starting, stopping, and normal operation.

D. Provide compressor with automatic capacity reduction equipment consisting of suction valve unloaders. Provide for unloaded compressor start.

E. Provide constant speed 1800 rpm compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, designed for across-the- line starting. Refer to Section 15170. Furnish with starter.

F. Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down. Energize heater continuously.

2.4 EVAPORATOR

A. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets. Provide multiple refrigerant circuits on multiple compressor units.

B. Design, test, and stamp refrigerant side for 225 psig (1550 kPa) working pressure and water side for 150 psig (1030 kPa) working pressure, in accordance with ANSI/ASME SEC 8.

C. Insulate with 0.75 inch (19 mm) minimum thick flexible expanded polyvinyl chloride insulation with maximum K value of 0.28 Btu in/Hr Sq Ft deg. F. Provide heat tape to protect evaporator to -20 degrees F (-29 degrees C).

D. Provide water drain connection and thermometer wells for temperature controller and low temperature cutout.

2.5 CONDENSERS

A. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits with liquid accumulators. Air test under water to 425 psig.

B. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. [Equip with roller or ball bearings with grease fittings extended to outside of casing.] Provide factory mounted, louvered, galvanized steel coil guard panels with lint screens.

C. Provide fan motors with permanently lubricated ball bearings and built-in current and overload protection. Refer to Section 15170.

2.6 ENCLOSURES

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

2.7 REFRIGERANT CIRCUIT

A. Provide refrigerant circuits, factory supplied and piped. Refrigerant will be R-134A.

B. Provide for each refrigerant circuit:

1. Liquid line solenoid valve.
2. Filter dryer (replaceable core type).
3. Liquid line sight glass and moisture indicator.
4. Thermal expansion valve sized for maximum operating pressure.
5. Charging valve.
6. Insulated suction line.
7. Discharge line check valve.
8. Compressor discharge service valve.
9. Condenser pressure relief valve.

2.8 CONTROLS

A. On chiller, mount weatherproof steel control panel, containing starters power and control wiring, molded case

disconnect switch, factory wired with single point power connection.

B. For each compressor, provide part winding starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection.

C. Provide the following safety controls with indicating lights arranged so that operating any one will shut down machine and require manual reset:

1. Low chilled water temperature switch.
2. High discharge pressure switch.
3. Low suction pressure switch.
4. Oil pressure switch.
5. Flow switch in chilled water line.
6. Relay for remote mounted emergency shut-down switch.

D. Provide the following operating controls:

1. Multi-step chilled water temperature controller which cycles compressors and activates cylinder unloaders.
2. Five minute off timer prevents compressor from short cycling.
3. Periodic pump-out timer to pump down on chilled water flow and high evaporator refrigerant pressure.
4. Solenoid valve between heat recovery condenser and receiver to limit refrigerant level in condenser.
5. Load limit thermostat to limit compressor loading on high return water temperature.
6. Low ambient control consisting of external damper assembly, controls head pressure for operation down to 0 degrees F (-18 degrees C).
7. Hot gas bypass sized for minimum compressor loading, bypasses hot refrigerant gas to evaporator.

E. Provide pre-piped gage board with pressure gages for suction and discharge refrigerant pressures, and oil pressures.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units in vibration isolation. Refer to Section 15245.

D. Connect to electrical service. Refer to Section 16180.

E. Connect to chilled water piping. Refer to Section 15510. On inlet, provide thermometer well for temperature controller, thermometer well for temperature limit controller, flow switch, flexible pipe connecter, and shut-off valve. On outlet, provide flexible pipe connecter and shut-off balancing valve.

F. Arrange piping for easy dismantling to permit tube cleaning.

3.2 MANUFACTURER'S FIELD SERVICES

A. Supply service of factory trained representative for a period of 2 days to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.

B. Supply initial charge of refrigerant and oil.

3.3 DEMONSTRATION

A. Demonstrate system operation and verify specified performance. Refer to Section 15990.

END OF SECTION

SECTION 15835

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Unit heaters.

B. Fan-coil units.

C. Unit ventilators (Rooftop Units).

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems: Installation of room thermostats.

B. Section 16180 - Equipment Wiring Systems: Installation of room thermostats.

1.3 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15170 - Motors.

C. Section 15510 - Hydronic Piping.

D. Section 15515 - Hydronic Specialties.

E. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

F. Section 16180 - Equipment Wiring Systems: Electrical supply to units.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. NFPA 70 - National Electrical Code.

B. ARI 440 - Room Fan Coil Air Conditioners.

C. UL 883 - Safety Standards for Fan Coil Units and Room Fan Heater Units.

D. Hydronics Institute HYI-01-I=B=R Ratings for Baseboard Radiation and Finned Tube (Commercial) Radiation.

1.5 SUBMITTALS: Submit shop drawings under provisions of Section 01300 and 15010.

A. Shop Drawings: Submit shop drawings indicating cross section of cabinets, grille, bracing and reinforcing, and typical elevation.

B. Product Data: Submit product data indicating typical catalog of information including arrangements.

C. Schedules: Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

D. Service Location: Indicate mechanical and electrical service locations and requirements, specifically indicating deviations from indicated products.

E. Installation Instructions: Submit manufacturer's installation instructions.

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 01000 and 15010.

B. Accurately record actual locations of access doors in radiation cabinets required for access or valving.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01000 and 15010.

B. Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 70 code for internal wiring of factory wired equipment.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 01000 and 15010.

B. Store and protect products under provisions of Section 01000 and 15010.

C. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.11 SEQUENCING AND SCHEDULING

A. Install fan-coil units and unit ventilators (equipment exposed to finished areas) after walls and ceiling are finished and painted. Avoid damage.

1.12 WARRANTY

A. Provide five year warranty.

B. Warranty: Include coverage of fan-coil unit, unit heater, and unit ventilator motors.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - UNIT HEATERS - FAN COIL UNITS

A. Airtherm Mfg Co.

B. Carrier Corp.

C. Dunham-Bush, Inc.

D. International Environmental Corp.

E. Modine Mfg Co.

F. Snyder General Corp.

G. Sterling Radiator

H. Trane Company

I. Hastings

J. Reznor

K. York International Corp.

L. Young Radiator Co.

2.2 UNIT HEATERS

A. Coils: Seamless copper tubing, 0.025 inch (0.64 mm) minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

B. Casing: 18 gage (1.3 mm) steel with threaded pipe connections for hanger rods.

C. Finish: Factory apply baked enamel of as selected on visible surfaces of enclosure or cabinet.

D. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

E. Air Outlet: Adjustable pattern diffuser on projection models and two way louvers on horizontal throw models.

F. Motor: Refer to Section 15170; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

G. Control: Local disconnect switch.

H. Capacity: Based on 65 degree F (18 degree C) entering air temperature, 180 degree F (82 degree C) average water temperature.

2.3 FAN-COIL UNITS

A. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi (1380 kPa) and 220 degrees F (104 degrees C). Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.

B. Cabinet: 16 gage (1.6 mm) steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation, and integral air outlet.

C. Finish: Factory apply baked enamel of color as selected on visible surfaces of enclosure or cabinet.

D. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

E. Motor: Refer to Section 15170; sleeve bearings, resiliently mounted.

F. Control: Multiple speed switch, factory wired, located in cabinet.

G. Filter: Easily removed 1 inch (25 mm) thick glass fiber throw-away type, located to filter air before coil.

H. Mixing Dampers: Where indicated, mixing sections with dampers. Refer to Section 15950 for operating sequence.

I. Capacity: Heating: Based on 68 degrees F (18 degrees C) entering air temperature, 180 degree F (82 degree C) average water temperature.

2.4 ACCEPTABLE MANUFACTURERS - UNIT VENTILATORS

A. Snyder General Corp.

B. Hastings.

C. Reznor.

D. Trane Company.

2.5 UNIT VENTILATORS - ROOFTOP UNITS (AHU-3 AND 4)

A. Chilled Water Coils: Copper tubes mechanically expanded into evenly spaced aluminum fins tested to operate at 150 psi (1030 kPa). Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.

B. Gas Burning Components: Gas-burning equipment shall include the gas burners, ignition equipment, gas-control valve, gas piping, gas-pressure regulating valve, when applicable, and accessories necessary for a fully automatic system that is listed in IAS-01. Gas-fired units equipped with programming controls shall be furnished both with high and with low gas supply pressure switches in the fuel supply piping. The heat exchanger shall be constructed of 409 stainless steel.

1. Ignition Systems: Gas-Fired Units: Ignition s systems shall be of the direct spark, hot surface, or interrupted intermittent type with automatic electric ignition. The pilots shall be of the electrically-ignited proven type. Continuous pilots will not be permitted. Burner shall be designed in accordance with NFPA 54/ANSI Z223.1 and located so that parts are protected against overheating. Provisions shall be made in the burner housing for inspection of the pilot flame.

Vent piping shall be in accordance with UL 441, Type

BW. Vent shall conform to NFPA 211 and NFPA 54/ANSI Z223.1. Plastic materials polyetherimide (PEI) and polyethersulfone (PES(are forbidden to be used for vent piping of combustion gases.

C. Weatherproof Cabinet: Insulated sandwich steel panels on solid base pan with exposed edges rounded. Provide removable front panels with quick-acting, key-operated camlocks. Provide removable die-cast or fabricated steel discharge grilles. For units having cooling coils, insulate internal parts and surfaces exposed to conditioned air stream with moisture resistant insulation.

D. Cabinet Accessories: Matching steel construction, reinforced, for use with unit ventilators or finned radiation, with steel alignment pins, adjustable kick plates with leveling bolts, shelves and sliding doors with locks as indicated, corner, end, and wall filler sections as required.

E. Finish: Factory apply baked enamel of color as selected on visible surfaces of enclosure or cabinet.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven, arranged to draw air through coil.

G. Motor: Refer to Section 15170; sleeve bearing, resiliently mounted.

H. Control: Specification Section 15950.

I. Mixing Dampers: Multi-blade with compressible seal, capable of varying proportion of mixed air from 100 percent room air to 100 percent outside air.

J. Heating Capacity: Based on 0 degree F entering air temperature, 180 degree F (82 degree C) average water temperature. See Rooftop Unit Schedule.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and opening dimensions are as instructed by the manufacturer.

B. Verify that required utilities are available, in proper location, and ready for use.

C. Beginning of installation means installer accepts existing

surfaces.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hang unit heaters from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

C. Install fan-coil units as indicated. Coordinate to assure correct recess size for recessed units.

D. Locate unit ventilators as indicated, level and shim units, and anchor to structure.

E. Protect units with protective covers during balance of construction.

F. Provide hydronic units with shut-off valve on supply and lockshield balancing valve on return piping. For fan coil units and unit heaters, provide float operated automatic air vents with stop valve.

3.3 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION

SECTION 15850

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency drives.

1.2 RELATED SECTIONS

A. DIVISIONS 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS: These shall apply to all work included in this section.

B. Related Work:

1. Section 15010 - BASIC MECHANICAL REQUIREMENTS.
2. Section 15170 - MOTORS.
3. Section 15855 - AIR HANDLING UNITS WITH COILS.
4. Section 15860 - CENTRIFUGAL FANS.
5. Section 15865 - AXIAL FANS.
6. Section 15950 - HEATING, VENTILATING AND AIR CONDITIONING HVAC CONTROL SYSTEMS.
7. Section 15980 - INSTRUMENTATION.
8. Section 15990 - TESTING, ADJUSTING AND BALANCING.
9. Division 16000 - ELECTRICAL (All Applicable Sections).

1.3 SCOPE OF WORK

A. The Contractor shall provide all materials, labor, tools, and equipment required for the proper installation of variable frequency drives as indicated on the plans, as specified herein, and as required for a complete and operational system.

B. Everything necessary for a complete and satisfactory installation, including all parts, devices, accessories, etc., required by applicable codes or that may be required to satisfactorily complete the installation of the variable frequency drives shall be provided by the Contractor.

C. All options as required in these specifications shall be provided.

D. All drives as indicated shall be from a single manufacturer.

1.4 SUBMITTALS: Data on all materials shall be furnished whether the items are as specified or an equal material is

proposed. See Sections 01300 and 15010 for submittal requirements.

A. Data Submittal shall show, as a minimum, the data as listed below. Equipment rejected in first submittal will be required to be furnished as specified. Substitutions will not be considered after original submittal has been reviewed.
   1. Name of manufacturer.
   2. Type of drive (type of inverter).
   3. Location and use.
   4. Enclosure type and exterior dimensions.
   5. Capacity of equipment.
   6. Circuit diagram.
   7. Certified performance test data for each drive type (e.g., PWM, VVI or CSI) and for each drive size shall include:

      a. Graph of drive efficiency versus load.
      b. Graph of input power factor versus load.

   8. Certified performance tests of the following shall include frequencies generated, their relative strengths, oscilloscope curve traces (if applicable) at twenty-five, fifty, seventy-five, and one hundred percent rated load. These tests shall be performed in relation to the performance of the motor operating across the line with the VFD in bypass mode for the largest drive of each type (e.g., PWM, VVI and CSI).

      a. Air-borne sound in drive shall not be excessive in the application intended.
      b. Harmonic reflected back into the power supply system based on IEEE519-1981 in the 5th and 7th order harmonics shall be limited to 5 and 10% respectively.
      c. Electromagnetic (EMI) and radio frequency (RFI) interference.

   9. Name, address, phone number of a factory-trained, 24 hour service agency.

B. Variable Frequency: Variable frequency drive submittals shall be bound, indexed, and tabbed. Loose and/or unorganized cut sheets will not be accepted. SUBMITTALS WHICH ARE NOT IN THE FORMAT AS INTENDED BY THIS SPECIFICATION WILL BE RETURNED UNCHECKED.

   1. If the submitted drive package differs in any respect from the requirements listed in this specification, then such differences shall be directly addressed. Each difference (whether it exceeds or lacks the

listed requirement) shall be listed in the submittal, and cross-referenced to the appropriate paragraph in this specification. Documentation shall also be included which supports the proposed drive package's status with regard to each of the differences encountered. Compensating options and features not specified shall also be included.

1.5 CODES AND STANDARDS (Latest edition or revision)

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. National Electrical Manufacturer's Association (NEMA) Publications:

1. ICS1-1978 - General Standards for Industrial Control and Systems.
2. ICS2-1978 - Standards for Industrial Control Devices Controllers and Assemblies
3. ICS4-1977 - Terminal Blocks for Industrial Control Equipment and Systems
4. ICS6-1978 - Enclosures for Industrial Controls and Systems

C. National Fire Protection Association (NFPA) Publication:

1. 70 (Latest Revision) - National Electrical Code (NEC).

D. Federal Communication Commission Rules, Part 15, Subpart J, Class A Equipment.

E. Institute of Electronic and Electrical Engineers (IEEE) Standard 519 - 1981.

1.6 OPERATION AND MAINTENANCE MANUALS

A. As specified in Section 01000 and 15010, the Contractor shall provide the Owner with bound copies of operations and maintenance data covering the drive and rating. Manuals shall be indexed and tabbed thereby organizing data. Basic troubleshooting criteria for drive and rating shall also be included. The Contractor shall provide in these manuals the name and telephone number(s) of a factory trained and qualified service organization within a 50 mile radius of a facility capable of servicing and repairing the VFD drive units. This service organization shall be available on a 24 hour per day basis, and shall keep in stock a ready supply of spare parts for drive rating and type.

1.7 WARRANTY

A. The VFD manufacturer shall provide a one year warranty from date of final acceptance covering all defects in materials and workmanship pertinent to the VFD unit. In addition the Contractor shall warrant to the Owner all work performed under this contract to be free from defects in workmanship and materials for a period of one year from date of final acceptance. Warranty shall also include all parts, labor, transportation and living expenses of factory personnel. Acceptance will not be given until all defects in all variable flow system components have been remedied, and each system successfully tested and run in its entirety. Defects arising during this period shall be promptly remedied by the Contractor at his own expense upon notice by the Owner.

1.8 INSPECTION OF SITE

A. Prior to submitting bid, the Contractor shall visit the site of the proposed construction and thoroughly acquaint himself with all facilities and working conditions to be encountered.

1.9 ACCURACY OF DATA

A. The drawings indicate the work intended. Care has been exercised to prepare the drawings as accurately as possible: however, accuracy is not guaranteed. It shall be the sole responsibility of the Contractor to verify all dimensions, take his own field measurements, and install all work to suit conditions encountered on the job site.

B. The drawings are generally diagrammatic and except where dimensions are indicated are not intended to show the exact locations of equipment. All work shall be installed as nearly as possible in the locations indicated, with minor adjustments as required to avoid interferences with structure or the work of other trades.

C. The Contractor is cautioned to pay particular attention to the space limitations for all equipment and determine before bidding that all equipment which he proposes to use will fit properly into the space provided, with adequate clearance for service and adjustments.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ASEA

B. York

C. Robicon Corp.

D. Graham Co.

E. Reliance Electric Co.

F. MagneTek, ASD Division

2.2 BASIC EQUIPMENT DESCRIPTION

A. This specification covers AC variable speed drives (adjustable frequency).

B. The drive shall be suitable for operation on standard NEMA design B motors and NEMA design F motors. The drive will have a diode bridge rectifier on the input to minimize the generation of electrical noise back into the line and provide near unity power factor.

C. The drive horsepower rating will range as scheduled, with a speed range of 3 to 60 Hz. The drive shall be capable of an overload of 120% for 60 seconds.

D. Output devices shall be transistors. For larger horsepowers an output filter shall be available as an option to reduce motor noise due to PWM waveform. In both cases audible noise shall be reduced so that it is at or near the noise levels common when running the motor on utility power.

E. The drive shall be UL or E.T.L. listed.

F. The drive shall be housed in a NEMA type one enclosure with metal cabinets for R.F. Shielding.

G. The drive shall be capable of operation under any combination of the following conditions without mechanical or electrical damage:

Ambient Temperature:	(14-104 degrees F)(-10 - 40 degrees
Relative Humidity:	Less than 90% non-condensing
Altitude:	Less than (3300 ft.)(1,000m) above sea level
Vibration:	Less than 0.5 G for 20-50 Hz

Less than 0.1mm (peak to peak) for 50-100 Hz

Control System:	Sinusoidal pulse width modulated voltage waveform
Output Voltage:	3 phase 380 to 460 Volt
Frequency Accuracy:	+/- 0.5% of max. frequency
Setting Frequency Range:	3 to 60 Hz
Volts/Hertz Ratio:	3 to 60 Hz, V/Hz dependent on load (automatic) 60 Hz and up, Voltage constant
Operation Frequency Range:	0 to 60 Hz

H. Overload Capacity: 120% for 60 seconds. A microprocessor shall monitor the load on the drive and in the event of an overload it shall, based on the calculation of a true inverse time overload characteristic, either trip out or phase back the voltage and speed as selected by an internal jumper.

I. Be able to operate under on site generated power as required.

2.3 DIGITAL READOUT AND MONITOR

A. Seven (7) segment LED's will display off, low speed, frequency and fault. With front accessible pushbutton, user can monitor % current, % voltage, frequency, acceleration and deceleration time, input bias, input gain, upper and lower limit. Drive readout also provides drive status and protective circuits status.

2.4 PROTECTION

A. The variable speed drive system shall include a diode bridge rectifier, capacitor filter, and transistorized inverter section. Base driver signals to control firing of the power transistors will be designed isolated for maximum protection of the control circuits from high voltage and noise. The output will be a sinusoidal waveform, pulse width modulated, voltage waveform for reduced harmonic heating in the motor.

B. The system protection as a minimum will provide the following:

1. Frequency Stall (110% causes acceleration stop, over 110% causes phase-back control).
2. Current Limit (120%).
3. Overcurrent - 180% IET.
4. Short Circuit - phase to phase or phase to ground (trips fault).
5. Overvoltage - High DC bus voltage (trips fault).
   460V Series 800VDC
6. Undervoltage - 85% below line voltage (indicates fault).
7. Component burnout - DC bus fuse protection and/or 3

phase input fusing.

C. Digital Indication of Fault: When the drive trips out on a fault, the drive shall activate a fault relay with normally open and normally closed contacts available to the user and an LED display shall indicate the reason for the trip as follows:

1. OC: Overcurrent trip at 120%
2. OCA: Internal component short circuit
3. OCL: Output short circuit
4. OL: Overload (when soft stall not selected)
5. OP: Overvoltage on DC bus
6. OPS: Overvoltage on input
7. UP: Undervoltage
8. OH: Overheat or Closing of terminals "OH"
9. EF: Ground Fault (Earth Fault)

D. Auto restart shall be a standard feature of the drive as follows:

1. Auto restart enable or disabled by jumper or programmable selection. Programmable drives shall be supplied with non-volatile RAM.
2. If auto restart is selected, the microprocessor shall determine, in the event of a fault, if a restart should be attempted. A restart will be attempted under the following conditions:

   a. Undervoltage (UP) - every time as soon as voltage returns to a safe level. Fault relay is not activated (not jumper selectable).
   b. Input Overvoltage (OPS) and DC Bus Overvoltage (OP) - every time if voltage returns to normal within 30 seconds, fault relay is not activated and reset for 30 seconds (jumper selectable).
   c. Overcurrent (OC) - drive delays 1 second and attempts a restart. If drive trips a second time, it delays 2 seconds and attempts a second restart. Overall, five attempts are made after successive delays of 1, 2, 4, 8, and 16 seconds. If the restart fails after the fifth attempt, the drive will trip out and activate the fault relay (jumper selectable).

3. A restart will not be attempted for any other type of fault and the drive will trip out immediately, activate the fault relay and make the appropriate indication on the display.

E. In the event of a fault trip, the microprocessor shall save the status of the drive at the time of the fault and make

that information available on the LED display until the drive is reset or the control power is removed.

F. An undervoltage condition of less than 30ms duration shall not affect drive operation. If main power falls below 85% of rated voltage for longer than 30ms while control power is retained, the drive shall forcibly decelerate the load in an attempt to force a higher bus voltage through regeneration. This feature, depending on the inertia of the load, shall allow the drive to "ride through" a longer condition.

G. Input Equipment: The VFD supplier shall supply the following with each drive:

1. Incoming motor circuit protector and thermal overload.
2. Mechanical transfer switch: For bypass of the inverter and transfer to line power. Transfer shall be via electrically operated contactor.
3. A.C. Line Reactor: For reduction of harmonic content, power factor improvement and line transient suppression to 2-1/2%.

H. Operational Functions:

1. Acceleration and deceleration time independently adjustable from 1 to 20/6 to 120 seconds (selectable ranges).
2. Signal follower 0-5VDC, 0-16VDC, 4-20ma, 0-20ma, selectable by jumper. An increasing input signal can command increasing or decreasing frequency as required by the application.
3. Ramp to stop or coast to stop for normal operation (coast to stop on fault).
4. Volts/Hertz patterns selectable by rotary switch or programmable capability.
5. Upper and lower frequency limit adjustments shall be available. When the drive reaches one of the limits, it shall activate an open collector signal available to the user. A dry contact signal shall be available as an option.

2.5 REQUIRED OPTIONS

A. Enclosure: All VFD components shall be factory mounted and wired in a grounded, wall mounted or free standing (as size of drive permits), NEMA 1 enclosure. The only additional wiring which will be required shall be to external alarm and controls, to the motor, and to the power source (motor control center, panelboard, etc.) as indicated on the plans or as specified.

B. Terminal Blocks: All external wiring connections for power,

signal, and alarm shall be facilitated by means of appropriately sized and rated terminal blocks located within the VFD enclosure. Fastening and electrical connection shall be made by a torqued, threaded lug or space type connector. Terminal blocks shall be insulated from the drive cabinet and other components and shall be CU/AL (copper/aluminum) rated.

C. Bypass: Constant speed bypass shall be provided as indicated on the drawings to allow the motor to run across the line in the event of a drive shutdown. The transfer from the drive to the line shall be manually initiated and electrically operated. The bypass controls shall include a lockout circuit to enable transfer from drive to bypass (and vice versa) only during motor standstill. Mounted on the cabinet door shall be the bypass selector switch, motor fault light, power ON light, motor "ON VFD" light, and motor "ON LINE" light. All bypass components and line reactors shall be mounted and factory wired with the VFD in a common enclosure for all drives 50 horsepower and below. Dual cabinets for larger drives are acceptable where space limitations are encountered. However all such cases shall be submitted to the engineer for approval with the submittal documents. Electrical control voltage shall be wired through a separate circuit for the bypass such that all power can be shut down to VFD circuit for maintenance.

D. Control Signal: Coordinate requirements with other applicable sections of these specifications. Also, a single dry contact closure from the facilities management system shall be capable of system shutdown or startup when in the variable flow or the bypass mode of operation. Shutdown in the variable flow mode shall be performed electronically and shall not interrupt input power to the VFD.

E. Depending upon the position of the manual/off/auto selector switch, the VFD shall operate as follows:

1. Selector switch in the OFF position: The VFD run circuit shall be open and the variable frequency drive shall not operate. Operation of the existing driven load via bypass mode shall be possible with the VFD in this stage.
2. Selector switch in the Manual position: The speed of the motor(s) shall be controlled by the manual speed potentiometer or electronic setting. All drive protective circuits shall be enabled, and alarm outputs shall be able to respond to actuation by drive protective circuitry. Manual transfer to variable speed operation shall also be possible.
3. Selector switch in the Auto position: Operating speed shall be determined by the input signal with motor speed being linearly proportional between minimum and maximum

speeds selected. All drive protective circuits shall be enabled, and alarm outputs shall be able to respond to actuation by drive protective circuitry. Manual transfer to constant speed operation shall also be possible.

F. Depending upon the position of the VFD/Bypass switch, the unit shall operate as follows:

1. Selector Switch in VFD Position: The manual/off/auto selector switch shall be enabled as indicated above and unit shall operate in normal VFD control.
2. Selector Switch in Bypass Position: The bypass for the VFD will be initiated and motor startup/shutdown will be allowed when the control signal initiates system start/or stop.

G. Provide single phase protection monitoring incoming power to protect in either bypass or VFD mode.

2.6 STARTUP AND SERVICE

A. Adjustable frequency controller shall be started by factory trained service personnel. Startup service shall include instruction of owner's personnel in proper operation.

PART 3 EXECUTION

3.1 DELIVERY AND STORAGE

A. Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before, during and after installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturer's recommendations and as approved by the Owner. Any damage to existing construction or to new equipment or materials which occurs as a result of improper action or inaction by the Contractor shall be remedied to the satisfaction of the Owner at no additional cost to the Owner.

3.2 INSTALLATION

A. Location: VFD shall be located approximately where shown on plans. However, minor adjustments shall be made as required to avoid installation of the drive cabinet where the drive may be subject to extremes of heat or moisture. Care shall be exercised to avoid location of the drive close to (or under) steam or water lines of any type, heaters or any other types of heat producing equipment. The drives shall also not be located close to any existing equipment which may be sensitive to radio frequency or electromagnetic emissions produced by the drive. The drives shall not be located close

to equipment which produces excessive vibration such as compressors of any type; drives especially shall not be installed on any mechanical equipment of any type.

B. Installations: Installation shall only be to building structure such as floors, columns, or concrete or steel structure per manufacturer's recommendations. Where installation of drive cabinets is to be on partitions of light construction (such as gypboard and studs) additional strut type bracing shall be provided. Cabinet anchoring devices shall be as approved by the Engineer. Nails will not be allowed. Where installation of drive is on floor, provide a 6" high housekeeping pad extending 6" (152 mm) beyond the limits of the cabinet for the front and both sides.

C. Connections: Electrical power and electrical control signal connections shall be made to the VFD drive via flexible metal conduit sized per the NEC. Connectors for flexible metal conduit shall have an integral grounding lug for use with an external grounding jumper wire.

D. Workmanship: All work shall be performed by skilled workmen under the supervision and guidance of a competent superintendent and shall present a neat and workmanlike appearance when complete.

E. Cleanup: Areas involved in the installation of the VFD shall be kept reasonably clean and free of excessive amounts of rubbish or waste materials caused by work under this contract. At the completion of work under this contract, all remaining rubbish and waste material shall be removed and the work site shall be left in clean condition.

3.3 SERVICE AND STARTUP

A. Startup: The VFD manufacturer shall provide the services of factory trained service personnel to check out drive installation and external connections to the drive. Factory trained service personnel shall conduct thorough tests of the drive to assure proper operation of the drive under normal conditions. All such defects which are discovered as a result of these tests shall be remedied and the drive retested until no additional defects are discovered. Startup services and tests shall be conducted in the presence of an Owner's representative; and a tag shall be placed in the VFD drive noting the date of successful startup tests and the initials of personnel conducting and witnessing startup tests. This date shall be the "date of final acceptance" as specified for the warranty period to begin. The controls and all peripheral equipment shall be fully functional before final acceptance is provided.

B. Training: The VFD manufacturer shall provide the training of Owner's personnel in basic troubleshooting of VFD drive. Training shall be on site and shall be a minimum duration of five (5) days in addition to system startup. Training shall occur only after successful startup of VFD system.

C. Training shall be coordinated with owner's representative who shall provide a written list of personnel to attend the training session. This training shall be performed using the prepared operation and maintenance manuals as specified as source materials.

3.4 TRAINING OF OWNER'S PERSONNEL AT VFD FACTORY

A. The VFD manufacturer shall provide classroom/factory training at the VFD factory for two (2) persons (as selected by the Owner), for three (3) 8-hour days. All expenses, including travel, lodging, and food shall be paid by the VFD manufacturer. The Owner shall incur no expenses for this factory training in VFD operation, trouble-shooting, and maintenance. Two sets of free manuals/literature shall also be provided to the Owner, in addition to other requirements in these specifications.

END OF SECTION

SECTION 15855

AIR HANDLING UNITS WITH COILS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged air handling units.

B. Heating coils.

C. Mixing boxes.

D. Combination filter/mixing boxes.

E. Filter sections.

F. Cooling coils.

G. Humidifiers.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15121 - Piping Expansion Compensation.

C. Section 15170 - Motors.

D. Section 15245 - Vibration Isolation.

E. Section 15290 - Ductwork Insulation.

F. Section 15860 - Centrifugal Fans.

G. Section 15865 - Axial Fans.

H. Section 15885 - Air Cleaning Devices.

I. Section 15890 - Ductwork.

J. Section 15910 - Ductwork Accessories: Flexible Duct Connections.

K. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

1.3 CODES AND STANDARDS
(Latest edition or revision).

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

D. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

E. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.

F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Roller Bearings.

G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

H. UL 181 - Factory-made Air Ducts and Connectors.

I. UL 586 - Test Performance of High Efficiency Particulate, Air Filter Units.

J. ANSI/UL 900 - Test Performance of Air Filter Units.

K. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

L. ARI 430 - Standard for Central-Station Air-Handling Units.

M. ARI 435 - Standard for Application of Central-Station Air-Handling Units.

N. ARI 610 - Central System Humidifiers.

O. NFPA 70 - National Electrical Code

P. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

Q. SMACNA - HVAC Duct Construction Standards - Metals and Flexible.

R. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

S. ASHRAE 52 - Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

T. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans.

U. FS F-F-300 - Filter, Air Conditioning: Viscous

Impingement and Dry types; Cleanable.

V. FS F-F-310 - Filter, Air Conditioning: Viscous Impingement and Dry Media, Replaceable.

W. FS F-F-320 - Filters, Electronic Air Cleaning, Ionizing Plate Type.

X. FS L-S-125 - Screening, Insect, Nonmetallic.

Y. FS RR-W-360 - Wire Fabric, Industrial.

Z. FS RR-W-365 - Wire Fabric (Insect Screening).

AA. IEEE 112 - Standard Test Procedure for Polyphase Induction Motors and Generators.

AB. NEMA MG1 - Motors and Generators.

AC. NEMA MG 10 - Energy Management Guide for Selection and Use of Polyphase Motors.

AD. CIDA-A-1419 - Filter Element, Air-Conditioning, (Viscous - Impingement and Dry Types, Replaceable).

1.4 QUALITY ASSURANCE

A. Fan Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301; tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.

C. Fabrication: Conform to AMCA 99 and ARI 430.

D. Filter Media: ANSI/UL 900 listed, Class I or Class II, approved by local authorities.

E. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

F. Air Handling Units: Products of manufacturer regularly engaged in production of components who issues complete catalog data on total product.

G. Humidifiers: Certify capacities and selection in accordance with ARI 610.

1.5 SUBMITTALS: Submit shop drawings and product data under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gages and finishes of materials, and electrical characteristics and connection requirements.
2. Provide data of filter media, filter performance data, filter assembly, and filter frames.
3. Provide fan curves with specified operating point clearly plotted.
4. Submit sound power level data for both fan outlet and casing radiation at rated capacity.
5. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Installation Instructions: Submit manufacturer's installation instructions.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit six operation and maintenance manuals under provisions of Section 01000 and 15010 shall list step-by-step procedures required for system startup, operation, shutdown, and routine maintenance at least 2 weeks prior to field training.

B. The manuals shall include the manufacturer's name, model number, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.

C. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement,

D. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, who issues complete catalog data on total product.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect products to site under provisions of Section 01000 and 15010.

B. Accept products on site under provisions of Section 01000 and 15010 in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

C. Store in clean dry place and protect from construction traffic, weather, humidity and temperature variations, dirt and dust, or other contaminants. Handle carefully to avoid damage to components, enclosures, and finish.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.10 EXTRA MATERIALS

A. Provide one set of disposable filters and fan belts.

1.11 FIELD TRAINING

A. Provide under provisions of Section 15010.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier Corp.

B. Snyder General Corp.

C. Trane Company

D. York International Corp.

2.2 GENERAL DESCRIPTION

A. Air Handling Units shall be single zone draw-thru type as

indicated.

B. Configuration: Fabricate with fan section plus accessories, including:

1. Heating coil section.
2. Filter section.
3. Cooling coil section.
4. Humidifier.
5. Vibration isolators.

C. Factory fabricate and test air handling units of sizes, capacities, and configuration as indicated and specified in accordance with AMCA 99 and ARI 430.

D. Base performance on local site conditions.

2.3 CASING

A. Construction: Construct of 18 gauge (1.3 mm) galvanized steel on channel base or drain pan. Fabricate channel base, and drain pans, or welded steel coated externally with zinc chromate, iron oxide, or phenolic resin paint. Inner casing of double-wall units shall be minimum 20 gauge (1.0 mm) galvanized steel.

B. Insulation: Insulate casing sections with 2 inch (51 mm) thick, 1-1/2 lbs/cu. ft (24 kg/cu. m) density, neoprene coated, glass fiber insulation, "K" value at 75 degrees F maximum 0.23 Btu*in/Hr*sq.ft.*degrees F ("k" value at 42 degrees C maximum 0.037 Watts/m*Degree K), sandwiched between outer wall of mill galvanized steel, and inner wall of galvanized perforated steel, with support members. Insulation shall conform to NFPA 90A.

C. Inspection Doors: Provide casings with inspection doors as indicated. Inspection doors shall be insulated, fully gasketed, double wall type, of a minimum 18 gauge (1.3 mm) outer and 20 gauge (1.0 mm) inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Provide minimum 8" x 8" (203 mm x 203 mm) inspection window of 1/4 inch (6 mm) thick plexiglass.

D. Access Doors: Provide casings with access doors as indicated. Access doors shall be insulated, fully gasketed, double wall type, of a minimum 18 gauge (1.3 mm) outer and 20 gauge (1.0 mm) inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Access doors shall be a minimum 24 inches (610 mm) wide and shall be full height of the unit casing or a minimum of 72" (1829 mm), whichever is less. Provide minimum 8" x 8" (203 mm x 203 mm) inspection window of 1/4 inch (6 mm) thick plexiglass.

E. Drain Pans: Construct drain pans from double thickness 16 gauge (1.6 mm) galvanized steel with insulation between layers, with welded corners. Cross break and pitch to drain connection. Provide drain pans under fan section, cooling coil section, and humidifier section.

F. Strength: Provide structure to brace casings for suction pressure of 2.5 inches wg (620 Pa), with maximum deflection of 1 in 200.

G. Lights: Provide lights in accessible sections with wire guards, factory wired to weatherproof switch and duplex outlet mounted on casing exterior.

2.4 FANS

A. Type: Provide fan section with air foil, double width, double inlet, centrifugal type fan as scheduled on Mechanical drawings. Refer to Section 15860.

B. Bearings: Provide self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of fan casing with aluminum tube and grease fittings rigidly attached to casing on drive side of air handler.

C. Mounting: Locate fan and motor internally on welded steel base coated with zinc chromate. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through hinged access doors. Provide built-in inertia base of welded steel with bottom sheet and reinforcing grid for concrete ballast. Mount base on vibration isolators. Refer to Section 15245.

D. Flexible Connection: Separate fan and coil sections with flexible connection. Refer to Section 15910.

2.5 MOTOR AND DRIVES

A. Motors: As indicated, in compliance with Section 15170.

B. Bearings: Fan bearings shall be sealed against dust and dirt, and shall be precision, self-aligning, grease-lubricated, heavy duty pillow block, ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by AFBMA 9 and AFBMA 11.

C. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

D. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and

adjustable pitch sheaves for motors 20 hp (15 kW) and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 25 hp (18.7 kW) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

E. Belt Guard: Fabricate to SMACNA Standards; 12 gage (2.8 mm) thick, 3/4 inch (19 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.6 COILS

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Drain Pans: 24 inch (610 mm) downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Eliminators: Provide eliminators of Type 304 stainless steel, mounted over drain pan.

D. Air Coils: Provide coils indicated for water cooling and hot water heating. Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

2.7 SELF-CONTAINED ELECTRONICALLY CONTROLLED HUMIDIFIER

A. Stainless steel dispersion tube panel with integral condensate drain. Absorption must take place within 18 inches of dispersion. Tanks must be removable for inspection, cleaning, and repair. Continuous self-diagnostics shall monitor the operation of the unit including safety shutdown indicating cause of failure. Dirty tank, highwater, fill and drain valve status, amp draw, demand percentage, and steam output shall be indicated on display.

1. Unit shall generated clean injectable steam from domestic water, shall shall have modulating control. All internal components shall be contained in a steel cabinet with keyed access. All piping and electrical connectors shall be provided.

2. Approved Manufacturers:

a) Armstrong
b) Dri-Steam

B. Provide water treatment of make-up water as necessary for direct steam injection. Refer to Section 15545, "Chemical Water Treatment".

2.8 FILTERS

A. Filter Box: Provide section with filter guides, access doors from both sides, for side loading.

B. Provide section with angle arrangement with 2 inch (51 mm) deep disposable, extended area panel filters. Refer to Section 15885.

C. Filter Gauges: Provide 3-1/2 inch (89 mm) diameter diaphragm actuated dial in metal case with static pressure tips. Refer to section 15980.

2.9 DAMPERS

A. Mixing Boxes: Provide section with factory mounted outside and return air dampers of galvanized steel with vinyl bulb edging and edge seals in galvanized frame, with galvanized steel axles in self-lubricating brass bearings, in opposed blade arrangement with damper blades positioned across short air opening dimension. Provide removable, full width rack for supporting freeze protection thermostat, with removable end panel to permit rack removal. Provide mixing box with integral angle filter rack for 2 inch (51 mm) deep, disposable, pleated media filters. Filter/mixing box shall have access doors for filter access.

B. Damper Leakage: Maximum 2 percent at 4 inch wg (1000 Pa) differential pressure when sized for 2000 fpm (10 m/sec) face velocity.

PART 3 EXECUTION

3.1 INSTALLATION

A. Work shall be installed as shown and in accordance with manufacturer's instructions, diagrams and recommendations and in conformance with ARI 435. Frames and supports shall be provided for items requiring supports.

B. Assemble high pressure units by bolting sections together. Isolate fan section with flexible duct connections.

C. Install each air handling unit on a 6 inch concrete housekeeping pad. Housekeeping pad shall extend 6 inches larger than the overall dimensions of the supported unit.

D. Install each filter type in accordance with manufacturer's directions.

E. Arrange installation of units to provide access space around air handling unit for service and maintenance.

F. Access panels shall be provided of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced.

3.2 CONNECTIONS

A. Arrange piping connections adjacent to units to allow unit servicing and maintenance.

B. Extend condensate drain lines to nearest floor drain and as indicated on mechanical drawings.

C. Install flexible duct connections to unit components and as indicated on mechanical drawings.

3.3 PERFORMANCE TESTS

A. Fan operation shall be stable over the entire volume range of the system.

3.4 CLEANING AND ADJUSTING

A. Temporary filters shall be provided for all air handling units that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenum, casings, and other items specified have been vacuum cleaned.

B. Air handling units shall be maintained in this clean condition until final acceptance.

C. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer.

D. Belts shall be tightened to proper tension.

E. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

END OF SECTION

SECTION 15860

CENTRIFUGAL FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Backward inclined centrifugal fans.

B. Airfoil centrifugal fans.

C. Tubular centrifugal fans.

D. Inline centrifugal fans.

E. Utility/vent sets.

F. Motors and drives

G. Fan Accessories.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15170 - Motors.

C. Section 15245 - Vibration Isolation.

D. Section 15290 - Ductwork Insulation.

E. Section 15855 - Air Handling Units With Coils.

F. Section 15890 - Ductwork.

G. Section 15910 - Ductwork Accessories: Backdraft dampers.

H. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

I. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. AMCA 99 - Standards Handbook.

D. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes

E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

F. AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.

G. NEMA MG1 - Motors and Generators.

H. NFPA 70 - National Electrical Code.

I. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

J. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.4 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.8 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide two sets of belts for each fan.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Acme Engineering & Mfg Corp.

B. Bayley Fan Group

C. Greenheck Fan Corp.

D. Loren Cook Co.

E. Snyder General Corp.

F. Trane Company

2.2 GENERAL

A. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300,and bear AMCA Certified Sound Rating Seal.

C. Fabrication: Conform to AMCA 99.

D. Performance Base: Sea level conditions.

E. Temperature Limit: Maximum 300 degrees F (150 degrees C).

F. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

2.3 WHEEL AND INLET

A. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate;

cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

B. Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

2.4 HOUSING

A. Heavy gage steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.

B. Factory finish before assembly with enamel or prime coat. For fans handling air downstream of humidifiers, provide two additional coats of paint.

C. Provide bolted construction with horizontal flanged split housing.

2.5 BEARINGS AND DRIVES

A. Bearings: AFBMA 9, L-10 life at 50,000 hours heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 L-10 life at 120,000 hours pillow block type, self-aligning, grease-lubricated roller bearings.

B. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil, and shaft guard.

C. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 20 hp (11.2 Kw) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 25 hp (15 Kw) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

D. Belt Guard: Fabricate to SMACNA Standard; of 12 gage (2.8 mm) thick, 3/4 inch (19 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.6 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:
1. Refer to Section 16180.

B. Motor: Refer to Section 15170 and NEMA MG1.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.7 ACCESSORIES

A. Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.

B. Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.

C. Scroll Drain: 1/2 inch (13 mm) steel pipe coupling welded to low point of fan scroll.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install fans as indicated, with resilient mountings and flexible electrical leads. Refer to Section 15245.

C. Install flexible connections specified in Section 15910 between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.

D. Install fan restraining snubbers as required. Refer to Section 15245. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Provide fixed sheaves required for final air balance.

F. Provide safety screen where inlet or outlet is exposed.

G. Pipe scroll drains to nearest floor drain.

H. Provide backdraft dampers on discharge of exhaust fans. Refer to Section 15910.

END OF SECTION

SECTION 15870

POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Wall exhausters.

C. Cabinet exhaust fans.

D. Ceiling exhaust fans.

1.2 RELATED SECTIONS

A. Section 15170 - Motors.

B. Section 15245 - Vibration Isolators.

C. Section 15860 - Centrifugal Fans.

D. Section 15865 - Axial Fans.

E. Section 15890 - Ductwork.

F. Section 15910 - Duct Accessories: Backdraft dampers.

G. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

H. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal.

D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

F. NEMA MG1 - Motors and Generators.

G. NFPA 70 - National Electrical Code.

H. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Vapors from Commercial cooking Equipment.

I. UL 705 - Power Ventilators.

1.4 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide two sets of belts for each fan.

1.7 FIELD TRAINING

A. Provide under provisions of Section 15010.

PART 2 PRODUCTS

2.1 ROOF EXHAUSTERS AND VENTILATORS

A. Acceptable Manufacturers:

1. Acme Engineering & Mfg Co.
2. Greenheck Fan Corp.
3. Loren Cook Co.
4. Trane Company

B. Product Requirements:

1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

2. Sound Ratings: AMCA 301, tested to AMCA 300,and bear AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.
4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Fan Unit: V-belt or direct driven as indicated, with spun aluminum fiberglass reinforced plastic housing; resilient mounted motor; 1/2 inch (13 mm) mesh, 16 gage (2 mm) aluminum birdscreen; square base to suit roof curb with continuous curb gaskets.

D. Roof Curb: 12 high of aluminum with continuously welded seams, 1 inch (25 mm) insulation and curb bottom, and factory installed nailer strip.

E. Electrical Characteristics and Components

1. Electrical Characteristics:
   a) Refer to Section 16180.
2. Motor: Refer to Section 15170. NEMA MG1.
3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
4. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

F. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with nylon bearings.

G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof and wall exhausters with cadmium plated steel lag screws to roof curb or wall structure.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Install flexible connections specified in Section 15910 between fan inlet and ductwork. Ensure metal bands of

connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

H. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 15885

AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disposable, extended area panel filters.

B. Disposable panel filters.

C. Filter frames.

D. Filter gages.

E. Dehumidifier.

1.2 RELATED SECTIONS

A. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. ARI 850 - Commercial and Industrial Air Filter Equipment.

B. ASHRAE 52 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

C. NFPA 70 - National Electrical Code.

D. UL 900 - Test Performance of Air Filter Units.

1.4 PERFORMANCE TOLERANCES

A. Conform to ARI 850 Section 7.4.

B. Dust Spot Efficiency: Plus or minus 5 percent.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300 and 15010.

B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

C. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics

and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide one set of disposable panel filters.

PART 2 PRODUCTS

2.1 DISPOSABLE, EXTENDED AREA PANEL FILTERS

A. Acceptable Manufacturers:

1. American Air Filter
(Snyder General Corp)

2. Cam-Farr, Co.
3. Eco-Air Products, Inc.

B. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to welded wire grid.

1. Frame: Non-flammable Cardboard.

2. Nominal size: 24 x 24 inches (610 x 610 mm).

3. Nominal thickness: 2 inches (50 mm).

C. Performance Rating, ASHRAE 52: See AHU Schedule.

2.2 FILTER FRAMES AND HOUSINGS

A. Acceptable Manufacturers:

1. American Air Filter
(Snyder General Corp)
2. Cam-Farr, Co.
3. Eco-Air Products, Inc.
4. Flanders Filters Inc.

B. General: Fabricate filter frames and supporting structures of 16 gage (1.6 mm) galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.

C. Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for 24 x 24 inches (610 x 610 mm) filter media, minimum 2 inches (51 mm) thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

D. Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 16 gage (1.6 mm) galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extruded aluminum tracks or channels for primary filters with positive sealing gaskets.

2.3 FILTER GAGES

A. Acceptable Manufacturers:

1. Dwyer Instruments Inc.
2. Honeywell, Inc.

B. Direct Reading Dial: 3-1/2 inch (89 mm) diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0-1.0 inch WG (0-250 Pa) 3 percent of full scale accuracy.

C. Accessories: Static pressure tips with integral compression fittings, 1/4 inch (6 mm) aluminum tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with

manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

E. Provide filter gages on filter banks, installed with separate static pressure tips upstream and downstream of filters.

END OF SECTION

SECTION 15890

DUCTWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

C. Kitchen hood ductwork.

D. Duct cleaning.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 11400 - Food Service Equipment: Supply of kitchen range hoods for placement by this Section.

1.3 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete.

B. Section 09900 - Painting: Weld priming, weather resistant, paint or coating.

C. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

D. Section 15140 - Supports and Anchors: Sleeves.

E. Section 15290 - Duct Insulation: External insulation and duct liner.

F. Section 15910 - Ductwork Accessories.

G. Section 15930 - Air Terminal Units.

H. Section 15940 - Air inlets and Outlets.

I. Section 15990 - Testing, Adjusting and Balancing.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASTM A 36 - Structural Steel.

B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.

E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

F. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.

J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

K. ASTM C 14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

L. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

M. ASTM C 920 - Elastomeric Joint Sealants.

N. ASTM E 814 - Fire Tests of Through-Penetation Fire Stops

O. AWS D1.1 - Structural Welding Code - Steel.

P. AWS D9.1 - Welding of Sheet Metal.

Q. FS TT-S-001657 - Sealing Compound, Single Component Butyl Rubber Based, Solvent Release Type.

R. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyestor Chemical Resistant Process Equipment.

S. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

T. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

U. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.

V. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

W. SMACNA - HVAC Air Duct Leakage Test Manual.

X. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

Y. SMACNA - Fibrous Glass Duct Construction Standards.

Z. UL 181 - Factory-Made Air Ducts and Connectors.

1.5 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.6 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for kitchen hood exhaust systems.

B. Product Data: Provide data for duct materials, duct liner, and duct connectors.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

D. Manufacturer's Installation Instructions.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

B. Maintain one copy of document on site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.10 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and NFPA 90B and NFPA 96 standards.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.

B. Steel Ducts: ASTM A366.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.

D. Flexible Ducts:

1. Acceptable Manufacturers:

a) Flexmaster U.S.A.. Inc.
b) Hart & Cooley, Inc.
c) Thermaflex

2. UL labeled, multiple layers of aluminum laminate supported by helically wound spring steel wire.
3. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
4. Maximum Velocity: 4000 fpm (20.3 m/sec).
5. Temperature Range: -20 degrees F to 210 degrees F (-28 degrees C to 99 degrees C).

E. Insulated Flexible Ducts:

1. Acceptable Manufacturers:

a) Flexmaster USA, Inc.
b) Hart & Cooley, Inc.
c) Thermaflex

2. Multiple layers of aluminum laminate supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
3. Pressure Rating: 10 inches WG (2.5 kPa) positive and 1.0 inches (250 Pa) negative.
4. Maximum Velocity: 4000 fpm (20.3 m/sec).
5. Temperature Range: -20 degrees F to 210 degrees F (-28 degrees C to 99 degrees C).

F. Stainless Steel Ducts: ASTM A167, Type 304 Stainless steel.

G. Fasteners: Rivets, bolts, or sheet metal screws.

H. Sealant:

1. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

I. Hanger Rod: ASTM A36; steel, galvanized; continuously threaded.

2.2 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees (0.26 rad) divergence wherever possible; maximum 30 degrees (0.52 rad) divergence upstream of equipment and 45 degrees (0.79 rad) convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA

Standard. Joints shall be minimum 4 inch (102 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree (0.79 rad)lateral wye takeoffs unless otherwise indicated where 90 degree (1.57 rad)conical tee connections may be used.

2.3 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

B. Transverse Duct Connection System:

1. SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.4 CASINGS

A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.

B. Mount floor mounted casings on 6 inch (150 mm) high concrete curbs. At floor, rivet panels on 8 inch(203 mm) centers to angles. Where floors are acoustically insulated, provide liner of 18 gage (1.3 mm) galvanized expanded metal mesh supported at 12 inch (305 mm) centers,turned up 12 inches (305 mm) at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 6 X 6 inch (152 X 152 mm) size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage (1.60 mm) back facing and 22 gage (0.85 mm) perforated front facing with 3/32 inch (2.4 mm)diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (76 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber media, on inverted channels of 16 gage (1.6 mm).

2.5 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

B. Construct of 18 gage (1.2 mm) stainless steel, using continuous external welded joints.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use crimp joints with or without bead for joining round duct sizes 8 inch (203 mm) and smaller with crimp in direction of air flow.

G. Use double nuts and lock washers on threaded rod supports.

H. Connect terminal units to supply ducts directly or with 1 foot (305 mm) maximum length of flexible duct. Do not use flexible duct to change direction.

I. Connect diffusers or light troffer boots to low pressure ducts with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

J. Connect flexible ducts to metal ducts with draw bands.

K. Set plenum doors 6 to 12 inches (152 to 305 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

L. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for ductwork exposed to view and

stainless steel for ducts where concealed.

M. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 CLEANING

A. Clean work under provisions of Section 01000 and 15010.

B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

C. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 SCHEDULES

A. DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply (Heating Systems)	Galvanized Steel
Low Pressure Supply (System with Cooling Coils)	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Kitchen Hood Exhaust	Stainless Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Toilet Room Exhaust	Aluminum

B. DUCTWORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
Supply (Heating Systems)	2 inch (500 Pa)
Supply (System with	

Cooling Coils)	2 inch (500 Pa)
Return and Relief	1 inch (250 Pa)
General Exhaust	1 inch (250 Pa)
Outside Air Intake	1 inch (250 Pa)
Combustion Air	1/2 inch (125 Pa)

END OF SECTION

SECTION 15910

DUCTWORK ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connections.

H. Smoke Dampers.

I. Volume control dampers.

1.2 RELATED SECTIONS

A. Section 15245 - Vibration Isolation.

B. Section 15890 - Ductwork.

C. Section 15930 - Air Terminal Units: Pressure regulating damper assemblies.

D. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS
(Latest Edition or Revision)

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. NFPA 92A - Smoke Control Systems.

C. NFPA 70 - National Electrical Code.

D. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

E. UL 33 - Heat Responsive Links for Fire-Protection Service.

F. UL 555 - Fire Dampers and Ceiling Dampers.

G. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

1.4 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of access doors and test holes.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01000 and 15010.

B. Protect dampers from damage to operating linkages and blades.

1.9 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

B. Provide two of each size and type of fusible link.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS.

A. Acceptable Manufacturers:

1. Air Balance, Inc.
2. Greenheck
3. Ruskin (Phillips Industries)
4. Vent Products Co., Inc.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage (1.6 mm) thick galvanized steel, or extruded aluminum, with center pivoted blades of maximum 6 inch (152 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree (1.57 Rad) stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

C. Gravity Backdraft Dampers, Size 18 x 18 inches (457 x 457 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturers standard construction.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. Greenheck
3. Ruskin (Phillips Industries)

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage (1.6 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3 x 13 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (13 mm) actuator shaft.

E. Operators: UL listed and labelled spring return electric

type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.

F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

H. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.4 DUCT ACCESS DOORS

A. Acceptable Manufacturers:

1. Air Balance, Inc.
2. Cesco Products
3. Ruskin (Phillips Industries)
4. Vent Products Co., Inc.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch (25 mm) thick insulation with sheet metal cover.

1. Less Than 12 Inches (305 mm) Square: Secure with sash locks.
2. Up to 18 Inches (457 mm) Square: Provide two hinges and two sash locks.
3. Up to 24 x 48 Inches (610 x 1220 mm): Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.5 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required.

Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.6 FIRE DAMPERS

A. Acceptable Manufacturers:

1. Air Balance, Inc.
2. Greenheck
3. Ruskin (Phillips Industries)

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage (0.83 mm) frame and 16 gage (1.6 mm) flap, two layers 0.125 inch (3 mm) ceramic fiber on top side, and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage (0.83 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for closure under air flow conditions. Configure with blades out of air stream.

F. Multiple Blade Dampers: 16 gage (1.6 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch (3 x 13 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

G. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C) with adjustable link straps for combination fire/balancing dampers.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Acceptable Manufacturers:

1. Durodyne Corp.
2. United McGill Corp.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Connector: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq.yd (1.0 kg/sq m).
   2. Net Fabric Width: Approximately 6 inches (152 mm) wide.
   3. Metal: 3 inch (76 mm) wide, 24 gage (0.70 mm thick) galvanized steel.

D. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

2.8 SMOKE DAMPERS

A. Acceptable Manufacturers:

   1. Air Balance, Inc.
   2. Ruskin (Phillips Industries)
   3. Greenheck

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Dampers: UL Class 1 curtain type fire damper, normally open automatically operated by electric actuator.

D. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.9 VOLUME CONTROL DAMPERS.

A. Manufacturers:

   1. Air Balance, Inc.
   2. Ruskin (Phillips Industries)
   3. Greenheck

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Splitter Dampers:

   1. Material: Same gage as duct to 24 inches (610 mm) size in either direction, and two gages heavier for sizes over 24 inches (610 mm).
   2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with

set screw.

D. Single Blade Dampers: Fabricate for duct sizes up to 12 x 36 inch (305 x 1220 mm).

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (203 x 1829 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ductwork 12 inches (305 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches (762 mm) provide regulator at both ends.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15890 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Provide minimum 8 x 8 inch (203 x 203 mm) size for hand access, 18 x 18 inch (457 x 457 mm) size for shoulder access, and as indicated. Provide 4 x 4 inch (102 x 102 mm) for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Refer to Section 15245.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Use splitter dampers only where indicated.

K. Provide balancing dampers on high velocity systems where indicated. Refer to Section 15930 - Air Terminal Units.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 15930

AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable volume terminal units.

B. Integral heating coils.

C. Integral damper motor operators.

D. Integral controls.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

B. Section 16180 - Equipment Wiring Systems: Thermostats and control components.

1.3 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 15170 - Motors.

C. Section 15510 - Hydronic Piping: Connections to heating coils.

D. Section 15515 - Hydronic Specialties: Connections to heating coils.

E. Section 15790 - Air Coils.

F. Section 15890 - Ductwork.

G. Section 15910 - Ductwork Accessories.

H. Section 15940 - Air Outlets and Inlets.

I. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

J. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ADC 1062 - Air Distribution and Control Device Test Code.

B. ARI 880 - Industry Standard for Air Terminal Units.

C. NFPA 70 - National Electrical Code.

D. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

E. UL 181 - Factory-Made Air Ducts and Connectors.

1.5 PERFORMANCE TOLERANCES

A. Base performance on tests conducted in accordance with ADC 1062.

1.6 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Schedule: Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg (250 to 1000 Pa).

D. Manufacturer's Installation Instructions: Indicate support and hanging details, and service clearances required.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of units, controls components.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01000 and 15010.

B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.10 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.11 WARRANTY

A. Provide five year warranty under provisions of Section 15010.

B. Warranty: Include coverage of operating controls.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Section 01000 and 15010.

1.13 FIELD TRAINING

A. Provide under provisions of Section 15010.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

1. Carnes Co.
2. Carrier Corp.
3. Tempmaster Corp.
4. Titus Products Div.
5. Trane Company

2.2 MANUFACTURED UNITS

A. Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with electric variable volume controls, hot water heating coils.

B. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

2.3 SINGLE DUCT VARIABLE VOLUME UNITS

A. Basic Assembly:
1. Casings: Minimum 22 gage (0.9 mm) galvanized steel.
2. Lining: Minimum 1 inch (25 mm) thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft (24 kg/cu m) density, meeting NFPA 90A requirements and UL 181 erosion requirements.
3. Plenum Air Inlets: Round stub connections for duct attachment.
4. Plenum Air Outlets: S slip and drive connections.

B. Basic Unit:

1. Configuration: Air volume damper assembly inside unit casing. Locate control conponents inside protective metal shroud.
2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 3 inches WG (750 Pa) inlet static pressure.
3. Mount damper operator to position damper normally closed.

C. Round Outlet: Discharge collar matching inlet size.

D. Hot Water Heating Coil:

1. Construction: 1/2 inch (13 mm) copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig (1380 kPa) pressure, factory installed.

E. Automatic Damper Operator:

1. Electric Actuator: 24 volt with remote temperature read and reset capability.

2. Velocity Reset Controller and Probe:

a) Pneumatic.
b) Calibration pressure taps for pressure independent control to compensate for varying inlet static pressure.
c) Minimum and maximum limits set at reset device.
d) Maintain air flow to within 5 percent of set point with inlet static pressure variations up to 4 inches.
e) Reset span, adjustable 3-8 psi (21-55 kPa) shall remain constant regardless of minimum or maximum setting. Reset start point shall be adjustable from 3-10 psi (21-69 kPa).

I. Thermostat: Wall-mounted electric type with appropriate mounting hardware. Refer to Section 15950.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Connect to ductwork in accordance with Section 15890.

E. Install heating coils in accordance with Section 15790.

F. Verify that electric power is available and of the correct characteristics.

3.2 ADJUSTING

A. Adjust work under provisions of Section 01000 and 15010.

B. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to 40 percent full flow.

END OF SECTION

SECTION 15940

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Kitchen Hoods.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 08111 - Standard Steel Doors: Placement of door grilles.

1.3 RELATED SECTIONS

A. Section 08111 - Standard Steel Doors: Door grilles.

B. Section 09900 - Painting: Painting of ductwork visible behind outlets and inlets.

C. Section 10211 - Fixed Metal Wall Louvers: Metal wall louvers.

D. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ADC 1062 - Certification, Rating and Test Manual.

B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.

C. ARI 650 - Air Outlets and Inlets.

D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

E. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

F. NFPA 70 - National Electrical Code.

G. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.5 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of air outlets and inlets.

1.7 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 RECTANGULAR CEILING DIFFUSERS

A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire
4. Titus Products Div.
5. Tuttle & Bailey

B. Type: Square and rectangular, multi-louvred diffuser to discharge air in 360 degree (6.28 Rad) four way pattern.

C. Frame: Surface mount or Inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Aluminum with baked enamel off-white finish.

E. Accessories: Radial opposed blade damper and

multi-louvered equalizing grid with damper adjustable from diffuser face.

2.2 CEILING SUPPLY REGISTERS/GRILLES

A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire
4. Titus Products Div.
5. Tuttle & Bailey

B. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

C. Frame: 1 inch (25 mm) margin with countersunk screw mounting and gasket.

D. Fabrication: Aluminum extrusions with factory off-white enamel finish.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.3 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire
4. Titus Products Div.
5. Tuttle & Bailey

B. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees (0.79 Rad), horizontal face.

C. Frame: 1 inch (25 mm) margin with countersunk screw mounting.

D. Fabrication: Steel with 20 gage (1.00 mm) minimum frames and 22 gage (0.90 mm) minimum blades, steel and aluminum with 20 gage (1.00 mm) minimum frame, or aluminum extrusions, with factory off-white enamel finish.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.4 WALL SUPPLY REGISTERS/GRILLES

A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire
4. Titus Products Div.
5. Tuttle & Bailey

B. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, horizontal face, double deflection.

C. Frame: 1 inch (25 mm) margin with countersunk screw mounting and gasket.

D. Fabrication: Steel with 20 gage (1.00 mm) minimum frames and 22 gage (0.90 mm) minimum blades, steel and aluminum with 20 gage (1.00 mm) minimum frame, or aluminum extrusions, with factory off-white enamel finish.

E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.5 WALL SUPPLY REGISTERS/GRILLES

A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire
4. Titus Products Div.
5. Tuttle & Bailey

B. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with two-way deflection.

C. Frame: 1 inch (25 mm) margin with countersunk screw mounting and gasket.

D. Fabrication: Aluminum extrusions with factory off-white enamel finish.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.6 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire
4. Titus Products Div.
5. Tuttle & Bailey

B. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, horizontal face.

C. Frame: 1 inch (25 mm) margin with countersunk screw mounting.

D. Fabrication: Steel and aluminum with 20 gage (1.00 mm) minimum frame, with factory off-white enamel finish.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.7 DOOR GRILLES

A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire
4. Titus Products Div.
5. Tuttle & Bailey

B. Type: V-shaped louvers of 20 gage (1.00 mm) thick steel, 1 inch (25 mm) deep on 1/2 inch (13 mm) centers.

C. Frame: 20 gage (1.00 mm) steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.8 ROOF HOODS

A. Acceptable Manufacturers:

1. Acme Engineering & Mfg Co.
2. Greenheck Fan Corp.
3. Loren Cook Co.

B. Fabricate air inlet or exhaust hoods in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Fabricate of galvanized steel, minimum 16 gage (1.6 mm) base and 20 gage (1.0 mm) hood, or aluminum, minimum 16 gage (1.6 mm) base and 18 gage (1.3 mm) hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch (13 mm) square mesh for exhaust and 3/4 inch (19 mm) for intake, and factory baked enamel finish.

D. Fabricate louver penthouses with mitered corners and reinforce with structural angles.

E. Mount unit on minimum 12 inch (305 mm) high curb base with insulation between duct and curb.

F. Make hood outlet area minimum of twice throat area.

2.9 KITCHEN RANGE HOOD - CANOPY TYPE

A. Construction shall be minimum 18 gauge Type 304 stainless steel. Seams shall be welded liquid tight, ground smooth and polished. Interior framing and brackets also to be of 304 stainless steel construction.

B. Stainless steel U.L. Classified grease filters shall be provided packaged with hood. Filter housing shall terminate into a full length, internal grease trough with removable grease container.

C. Vaporproof, U.L. listed incandescent light fixtures shall be installed, and shall provide a lighting level of 75 ft. candles at the cooking surface.

D. Hoods shall be constructed in accordance with NFPA 96 and bear National Sanitation Foundation approval.

E. A wet chemical fire suppression system in accordance with NFPA 96, and including but not limited to: charged wet chemical cylinder, nozzles, fuel shutoff, automatic and manual activation shall be provided.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09900.

END OF SECTION

SECTION 15950

HEATING, VENTILATING AND AIR CONDITIONING HVAC CONTROL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500	(1989) Test Methods for Louvers, Dampers, and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 269	(1990a) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM B 88	(1992) Seamless Copper Water Tube
ASTM D 635	(1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D 1693	(1970; R 1988) Environmental Stress-Cracking of Ethylene Plastics

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE-03	(1989) Handbook, Fundamentals I-P Edition

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-16	(1989; Addenda 1989, 1990, 1991) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME B16.34	(1988) Valves - Flanged, Threaded, and Welding End

ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

CODE OF FEDERAL REGULATIONS (CFR)

CFR 47 Part 15	Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(1989) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-07	(1983) HVAC Systems - Testing, Adjusting and Balancing

UNDERWRITERS LABORATORIES (UL)

UL 94	(1991) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 268A	(1983; Rev thru Mar 1986) Smoke Detectors for Duct Application
UL 555S	(1983) Leakage Rated Dampers for Use in Smoke-Control Systems
UL 916	(1984) Energy Management Equipment

1.2 GENERAL REQUIREMENTS

A. Standard Products

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior

to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. The Contractor shall submit a certified list of qualified permanent service organizations and qualifications. These service organizations shall be reasonably convenient to the equipment on a regular and emergency basis during the warranty period.

A. Identical Items

Items of the same classification as specified in PART 2 - PRODUCTS shall be identical, including equipment, assemblies, parts, and components.

B. Nameplates, Lens Caps, and Tags

Nameplates and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. Nameplates shall be mechanically attached to HVAC control panel interior doors. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each air flow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

C. Verification of Dimensions

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

D. Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

E. Power-Line Surge Protection

All equipment connected to ac circuits shall be protected from power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

F. Surge Protection for Transmitter and Control Wiring

All HVAC system control-panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

1. A 10-microsecond by 1000-microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
2. An 8-microsecond by 20-microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.3 SUBMITTALS:

A. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS and Section 15010:

HVAC Control System Data.

Manufacturer's equipment data, product specific catalog cuts, and an ASME air-storage tank certificate. Catalog cuts shall be in booklet form indexed by device type. Where multiple components are show on a catalog cut, the application-specific component shall be marked.

B. Training.

A training course in the maintenance and operation of the HVAC control systems specified, 60 days prior to the start of training. The training shall be oriented to the specific systems being installed under this contract. One training manual shall be furnished for each trainee, plus two additional copies delivered for archival storage at the project site. The manuals shall include the agenda, the defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Two copies of audiovisual materials shall be delivered for archival storage at the project site, either as a part of the printed training manuals or on the same media as that to be used during the training session.

C. Equipment.

The equipment data shall be in booklet form and indexed to the unique identifiers. Data sheets that document compliance with the specification and a copy of each HVAC control system bill of materials.

D. HVAC control system drawings.

Drawings shall include: a drawing index; a list of symbols; a series of drawings for each HVAC control system using abbreviations, symbols, nomenclature and identifiers as shown on the contract drawings; valve schedules; damper schedules; and a compressed-air station schematic on 34-inch by 22-inch (841 by 594 mm) sheets. All detail drawings shall be delivered together as a complete package. Valve and damper schedules may be submitted in advance but shall be included in the complete submittal. Each control-system element on a drawing shall have a unique identifier as shown.

E. Each series of drawings for an HVAC control system shall include a schematic as shown, a ladder diagram as shown, an equipment schedule as shown, a wiring diagram, a list of equipment with manufacturer and model number, a control-panel arrangement drawing, and an HVAC control-system sequence of operation.

F. The wiring diagram shall show the interconnection of conductors and cables to HVAC control-panel terminal blocks and to the identified terminals of starters and packaged equipment, with all necessary jumpers and ground connections. The wiring diagram shall show the labels of all conductors. All sources of power required for HVAC control systems and for packaged-equipment control systems shall be identified back to the panelboard circuit breaker number, HVAC system control panel, magnetic starter, or packaged control equipment circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

G. The HVAC control-panel arrangement drawing shall show nameplate legends, fabrication details, and enclosure operating temperature- rise calculations. Fabrication details shall include interior door front and rear views, back panel layout and terminal block layout.

H. The sequence of operation for each HVAC control system shall be in the language and format of this specification. No operational deviations from specified sequences will be permitted without prior written approval of the Contracting

Officer. The sequence of operation shall refer to each device by its unique identifier.

I. The valve schedule shall include each valve's unique identifier, size, flow coefficient (Cv), pressure drop at specified flow rate, spring range, positive-positioner range, and actuator size, supported by close-off pressure data, dimensions, operation rate, and access and clearance requirements data.

J. The damper schedule shall contain each damper's and each actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive-positioner ranges, locations of actuators and damper end switches, arrangement of sections in multisection dampers, and methods of connecting dampers, actuators, and linkages. The damper schedule shall include the maximum expected velocity through the damper at the intended location and the maximum leakage rate at the operating static-pressure differential.
The damper schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements.

K. The compressed-air station schematic diagram shall show all equipment, including: compressor with motor wattage (horsepower) (horsepower) and voltage; starter; isolators; manual bypasses; tubing sizes; drain piping and drain traps; reducing valves; dryer; and data on manufacturer's names and model numbers, mounting, access, and clearance requirements. Air-compressor and air-dryer data shall include calculations of the air consumption of all current-to-pneumatic transducers (IP's) and of any other control-system devices to be connected to the compressed-air station, the number of starts per hour and the running time for the unit selected, and the compressed air-supply dewpoint temperature at 20 psig 20 psig (138 kPa).

L. Service Organization Instructions.

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name and telephone number.

M. Testing, Commissioning, and Balancing Reports

Six copies of the site testing procedures shall identify each item to be tested and shall clearly describe each test. The test procedures shall include a list of the test equipment to be used for site testing, manufacturer and

model number, and the date of calibration and accuracy of calibration within 6 months of the test date. Six copies of the site testing data. Original copies of all data produced during site testing, including results of each test procedure, after approval of the site tests. Six copies of the performance verification test plans and procedures. The test plan and procedures for the performance verification test, indexed and in booklet form, 60 days before scheduled test dates. Six copies of the performance verification test report, after completion of a successful test. Documentation of test results for the entire HVAC control system, complete and in booklet form and indexed, within 30 days after each test.

N. Testing, Commissioning, and Balancing Records

Six copies of the calibration, adjustment and commissioning report which shall include controller setpoints and proportional, integral and derivative-mode constant settings, calibration data for all instruments and controls, and all the data resulting from adjusting the control-system devices and commissioning HVAC control system.

O. Operation and Maintenance Manuals

HVAC Control System

Six complete copies of operation manuals for each HVAC control system, in booklet form and indexed, outlining the step-by-step procedures required for each HVAC control system's startup, operation, and shutdown. The manuals shall include all detail drawings, equipment data, each controller's configuration check sheet and manufacturer supplied operation manuals for all equipment. Six complete copies of maintenance manuals, indexed in booklet form listing maintenance procedures. The maintenance instructions shall include a maintenance check list for each HVAC control system. Maintenance manuals shall include spare parts data and recommended maintenance tool kits for all control devices. Maintenance instructions shall include recommended repair methods, either field repair, factory repair, or whole-item replacement. If operation and maintenance manuals are provided in a common volume, they shall be clearly differentiated and separately indexed.

P. Commissioning Procedures

Commissioning Procedures for each HVAC control system, and for each type of terminal-unit control system. The procedures shall reflect the language and format of this

specification. The commissioning procedures shall refer to the devices by their unique identifiers as shown. The commissioning procedures shall include step-by-step configuration procedures for each controller. The configuration procedures shall be product specific and shall include a configuration check sheet showing all configuration parameters, dip switch settings, initial recommended P, I and D constants.

Six copies of Commissioning Procedures, 60 days prior to system commissioning, in booklet form and indexed, for each type of control device provided, such as controllers, pilot positioners, adjustable relays, and transmitters. Commissioning procedures shall include general instructions on how to set control parameters, including: setpoints; proportional, integral, and derivative mode constants; contact output settings for the specific devices provided. Commissioning procedures shall be specific to each HVAC system, shall detail the steps involved, and shall refer to the procedures in the booklet for specific devices.

1.4 DELIVERY AND STORAGE

A. Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

A. Electrical and Electronic Devices

All electrical, electronic, and electro-pneumatic devices not located within an HVAC control panel shall have an enclosure NEMA 1 in accordance with NEMA 250 unless otherwise shown.

B. Standard Signals

The output of all analog transmitters and the analog input and output of all single-loop controllers and function modules shall be 4-to-20 mADC signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

C. Ambient Temperature Limits

Actuators and positive positioners, and transmitters shall operate within temperature limit ratings of plus 35 to 150 degrees F (2 to 49 degrees C). All panel-mounted instruments shall operate within limit ratings of 35 to 120 degrees F and 10 percent to 95 percent relative humidity, noncondensing. All devices installed outdoors shall operate within limit ratings of minus 35 to 150 degrees F (minus 37 to 66 degrees C).

2.2 MATERIALS

A. Tubing

1. Copper

Copper tubing shall conform to ASTM B 88 and shall have sweat fittings and valves.

2. Plastic

Plastic tubing shall have barbed fittings and valves. Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification, and shall withstand stress cracking when tested in accordance with ASTM D 1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

3. Stainless Steel

Stainless steel tubing shall conform to ASTM A 269, and shall have stainless steel compression fittings.

B. Wiring

1. Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2. Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 14 AWG minimum and shall be rated for 300-volt service.

3. Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 16 AWG minimum and shall be rated for 600-volt service.

4. Analog Signal Wiring Circuits

Analog signal wiring circuits within control panels shall not be less than 20 AWG and shall be rated for 300-volt service.

5. Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single or multiple-twisted, minimum 2-inch (51 mm) lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20-AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20-AWG tinned-copper cable drain wire, and overall cable insulation.

6. Nonconducting Wiring Duct

Nonconducting wiring duct in control panels shall have slotted sides, snap-on duct covers, fittings for connecting ducts, mounting clips for securing ducts, and wire-retaining clips.

2.3 ACTUATORS

A. General Requirements

Actuators shall fail to their spring-return positions as shown on signal or power failure and shall have a visible position indicator. Actuators shall open or close the devices to which they are applied within 60 seconds after a full scale input signal change. Electric or electronic actuators operating in parallel or in sequence shall have an auxiliary actuator driver. Pneumatic actuators shall be rated for 25 psig (172 kpa) operating pressure except for high-pressure cylinder-type actuators. Actuators shall be pneumatic, electric or electronic as shown.

B. Damper Actuators

Actuators shall smoothly operate the devices to which they are applied. Actuators shall fully open and close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. The actuator stroke shall be limited by an adjustable stop in the

direction of power stroke. The actuators shall be provided with mounting and connecting hardware.

C. Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

D. Positive Positioners

Each positive positioner shall be a pneumatic relay with a mechanical feedback mechanism and an adjustable operating range and starting point.

2.4 AUTOMATIC CONTROL VALVES

A. Valve Assembly

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall be designed for not less than 125 psig (860 kPa) working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be .01 percent of rated Cv.

B. Butterfly-Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service, and for modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 20 to 250 degrees F (minus 29 to 121 degrees C). Valves shall have a manual means of operation independent of the actuator.

C. Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

D. Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

E. Duct-Coil and Terminal-Unit-Coil Valves

Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be furnished for each flare-type end valve.

F. Valves for Chilled-Water and Glycol Service

Bodies for valves 1-1/2 inches (38mm) and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 inches to 3 inches (50mm to 80mm) inclusive shall be of brass, bronze or iron. Bodies for 2-inch (50mm) valves shall have threaded ends. Bodies for valves from 2-1/2 inches to 3 inches (65mm to 80mm) shall have flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal valve trim shall be brass or bronze except that valve stems may be type 316 stainless steel. Valves 4 inches (102mm) and larger shall be butterfly valves.

G. Valves for Hot-Water Service Below 250 Degrees F (121 Degrees C)

Bodies for valves 1-1/2 inches (38mm) and smaller shall be brass or bronze, with threaded or union ends. Bodies for 50 mm 2-inch (51mm) valves shall have threaded ends. Bodies for valves from 2 inches to 3 inches (50mm to 80mm) inclusive shall be of brass, bronze, or iron. Bodies for valves 4 inches (102mm) and larger shall be iron. Bodies for valves 2-1/2 inches (64mm) and larger shall be provided with flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F (99 degrees C) shall be Type 316 stainless steel. Internal trim for valves controlling water 210 degrees F (99mm) or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F (121 degrees C) or 50 degrees F above the system design temperature, whichever is higher. Valves 4 inches (102mm) and larger shall be butterfly valves.

2.5 DAMPERS

A. Damper Assembly

A single damper section shall have blades no longer than 48 inches (1219mm) and shall be no higher than 72 inches (1829mm). Maximum damper blade width shall be 8 inches (203mm). Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by foldingthe edges. All blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section will not be located directly in the air stream. Damper axles shall be 0.5-inch (13mm) minimum plated steel rods supported in the damper frame by

stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inch water gauge (10Pa)at 1,000 fpm (5m/s) in the wide-open position. Frames shall not be less than 2 inches (51mm) in width. Dampers shall be tested in accordance with AMCA 500.

1. Operating Links

   Operating links external to dampers (such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers) shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

2. Damper Types

   Dampers shall be parallel blade type.

B. Outside-Air, Return-Air, and Relief-Air Dampers

   The dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot (102 L/S per square meter) at 4 inches water gauge (1000 Pa) static pressure when closed. Seals shall be suitable for an operating temperature range of 40 degrees F to 200 degrees F (minus 40 degrees C to 93 degrees C). Dampers shall be rated at not less than 2000 fpm (10/m/s) air velocity.

C. Mechanical and Electrical Space Ventilation Dampers

   The dampers shall be as shown. Dampers shall not leak in excess of 80 cfm per square foot (406 L/S per square meter) at 4 inches (995Pa) water gauge static pressure when closed. Dampers shall be rated at not less than 1500 fpm (7.8 m/s) air velocity.

D. Smoke Dampers

   Smoke-damper and actuator assembly required per NFPA 90A shall meet the Class II leakage requirements of UL 555S. Dampers shall be rated at not less than 2000 fpm (10 m/s) air velocity.

E. Damper End Switches

Each end switch shall be a hermetically-sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

2.6 DUCT SMOKE DETECTORS

A. Duct smoke detectors shall be provided in supply and return air ducts in accordance with NFPA 90A. Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 500 fpm (25 m/s) and 4000 fpm (20 m/s). Detectors shall be powered from the HVAC control panel. Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted eight feet or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as the affected fan unit(s) shall be properly identified in etched rigid plastic placards.

2.7 INSTRUMENTATION

A. Measurements

Transmitters shall be calibrated to provide the following measurements, over the indicated ranges, for an output of 4 to 20 mAdc:

1. Conditioned space temperature, from 50 to 85 degrees F (10 to 29 degrees C).
2. Duct temperature, from 40 to 140 degrees F (5 to 60 degrees C) except that return-air temperature for economizer operation shall be minus 30 to plus 130 degrees F (minus 34 to 54 degrees).
3. Chilled-water temperature, from 30 to 100 degrees F (minus 1 to 38 degrees C).
4. Heating hot-water temperature, from 100 to 250 degrees F (38 to 121 degrees C).
5. Condenser-water temperature, from 30 to 130 degrees F (minus 1 to 54 degrees C).

Outside-air temperature, from minus 30 to 130 degrees F.

6. Relative humidity, 0 to 100 percent for space and high-limit applications (minus 34 to 54 degrees C).
7. Differential pressure for VAV supply-duct static pressure from 0 to 2.0 inches water gauge (0 to 500 Pa).
8. Pitot-tube air-flow measurement station and transmitter, from 0 to 0.1 inch water gauge for flow velocities of 700 to 1200 fpm (3.6 to 6.1 m/s), 0 to 0.25 inch (water gauge (0 to 62 Pa) for velocities of 700 to 1800 fpm (3.6 to 9.1 m/s), or 0 to 0.5 inch water gauge (0 to 125 Pa) for velocities of 700 to 2500 fpm (3.6 to 12.7 m/s).
9. Electronic air-flow measurement station and transmitter, from 125 to 2500 fpm (0.63 to 12.7 m/s).

B. Temperature Instruments

1. Resistance Temperature Detectors (RTD)
Temperature sensors shall be 100 ohms 3-wire RTD. Each RTD shall be platinum with a tolerance of plus or minus 0.1 percent at 32 degrees F (0 degrees C), and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally-mounted unless otherwise shown.
2. Continuous-Averaging RTD
Continuous-averaging RTDs shall have a tolerance of plus or minus 1.0 degree F (0.6 degree C) at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross-section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter as specified, to match the resistance range of the averaging RTD.
3. RTD Transmitter
The RTD transmitter shall accept a 3-wire 100 ohm RTD input. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated span. The transmitter shall include offset and span adjustments.

C. Relative-Humidity Instruments

A relative-humidity instrument for indoor application shall have a measurement range from 0 to 100 percent relative-humidity and be rated for operation at ambient air temperatures within the range of 25 to 130 degrees F (minus 4 to 54 degrees C). It shall be capable of being exposed

to a condensing air stream (100 percent RH) with no adverse effect to the sensor's calibration or other harm to the instrument. The instrument shall be of the wall-mounted or duct-mounted type, as required by the application, and shall be provided with any required accessories. A duct-mounted instrument shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage. The instrument (sensing element and transmitter) shall be a 2-wire, loop-powered device and shall have an accuracy of plus or minus 2 percent of full scale within the range of 20 to 90 percent relative humidity. In the range of 90 to 100 percent relative humidity, the instrument's accuracy shall be within plus or minus 3 percent of full scale. The instrument shall have a typical long-term stability of 1 percent or less drift per year. The transmitter shall convert the sensing element's output to a linear 4-20 mAdc output signal in proportion to the measured relative-humidity value. The transmitter shall include offset and span adjustments.

D. Electronic Air-Flow-Measurement Stations and Transmitters

1. Stations

Each station shall contain an array of velocity sensing elements inside a flanged sheet-metal casing. The velocity sensing elements shall be of the RTD or thermistor type, with linearizing means. The sensing elements shall be distributed across the duct cross-section in the quantity and pattern set forth for measurements and instruments of ASHRAE-03 and SMACNA-07 for the traversing of ducted air flows. The resistance to air flow through the air-flow measurement station shall not exceed 0.08 inch water gauge (19.9 Pa) at an air flow of 2000 fpm (10.2 m/s). Station construction shall be suitable for operation at air flows of up to 5000 fpm (25.4 m/s) over a temperature range of 40 to 120 degrees F (4.4 to 49 degrees C), and accuracy shall be plus or minus 3 percent over a range of 125 to 2500 fpm (0.63 to 12.7 m/s) scaled to air volume.

2. Transmitters

Each transmitter shall produce a linear, temperature compensated 4-to-20 mAdc output corresponding to the required velocity measurement. The output error of the transmitter shall not exceed 0.5 percent of the calibrated measurement. Each transmitter shall have offset and span adjustments.

E. Pitot-Tube Air-Flow-Measurement Stations and Transmitters

1. Stations

Each station shall contain an array of velocity sensing elements and straightening vanes inside a flanged sheet-metal casing. The velocity sensing elements shall be of the multiple pitot-tube type with averaging manifolds. The sensing elements shall be distributed across the duct cross-section in the quantity and pattern set forth for measurements and instruments of ASHRAE-03 or SMACNA-07 for the traversing of ducted air flows. The resistance to air flow through the air-flow-measurement station shall not exceed 0.08 inch water gauge (19.9 Pa) at an air flow of 2000 fpm. (10.2 m/s) Station construction shall be suitable for operation at air flows of up to 5000 fpm (25.4 m/s)over a temperature range of 40 to 120 degrees F (4.4 to 49 degrees C),, and accuracy shall be plus or minus 3 percent over a range of 500 to 2500 fpm (2.5 to 12.7 m/s) scaled to air volume. This device will not be used if the required velocity measurement is below 700 fpm (3.6 m/s).

2. Transmitters

Each transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required velocity pressure measurement. Each transmitter shall have a low-range differential-pressure sensing element and a square-root extractor. Sensing element accuracy shall be plus or minus 1 percent of full scale, and overall transmitter accuracy shall be plus or minus 0.25 percent of the calibrated measurement. Each transmitter shall have offset and span adjustments.

F. Differential Pressure Instruments

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure. The sensor/transmitter assembly accuracy shall be plus or minus 2 percent of full scale. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required pressure measurement. Each transmitter shall have offset and span adjustments.

G. Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2-inch (51mm) lagging neck and extension-type well, and inside diameter and insertion length as required for the application.

H. Sunshields

Sunshields for outside-air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized-metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white or shall be unpainted aluminum.

I. Passive Infrared Sensor

Infared motion sensor for wall mounting, with 1000 square foot minimum coverage. Fresnel lense to provide trapezodial viewing pattern. Unit shall have integral adjustable timer (30 sec to 20 min) to delay activation. Power supply characteristics: 120 V, single phase, 60 Hz. Switching capacity minimum 110 mA. Provide sensors in sufficient quantity to completely monitor the enclosed spaces.

2.8 THERMOSTATS

A. General

Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 10 degrees F (5 degrees C) of the setpoint shown. Thermostats shall be electronic or low-voltage electric.

B. Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F (2.8 degrees C). Room thermostats shall be enclosed with separate locking covers (guards). Thermostats shall have manual switches as required by the application.

C. Microprocessor-Based Room Thermostats

Microprocessor-based thermostats shall have built-in keypads for scheduling of day and night temperature settings. When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature setpoint on demand, or continuous display of temperature setpoint with display of room temperature on demand. In the programmable mode, the display shall be used for setting and interrogating time program ON-OFF setpoints for all 7 days of the week. The time program

shall allow 2 separate temperature-setback intervals per day. The thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for 1 year in the event of a power outage. Maximum differential shall be 2 degrees F (1.1 degrees C).

D. Modulating Room Thermostats

These thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 4 to 8 degrees F (2.2 to 4.4 degrees C) for each output. Room thermostats shall be enclosed with separate locking covers (guards).

E. Nonmodulating Capillary Thermostats and Aquastats

Each thermostat shall have a capillary length of at least 5 feet (1.5m), shall have adjustable direct-reading scales for both setpoint and differential, and shall have a differential adjustable from 6 to 16 degrees F (3.3 to 8.9 degrees C). Aquastats shall be of the strap-on type, with 10 degrees F (5.6 degrees C)fixed differential.

F. Low-Temperature-Protection Thermostats

Low-temperature-protection thermostats shall be, low-temperature safety thermostats, with NO and NC contacts and a 20-foot (6.1m) element which shall respond to the coldest 18-inch (457mm)segment.

G. Modulating Capillary Thermostats

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 4 to 8 degrees F (2.2 to 4.4 degrees C)for each output.

2.9 PRESSURE SWITCHES AND SOLENOID VALVES

A. Pressure Switches

Each switch shall have an adjustable setpoint with visible setpoint scale. Range shall be as shown. Differential adjustment shall span 20 to 40 percent of the range of the device.

B. Differential-Pressure Switches

Each switch shall be an adjustable diaphragm-operated device with 2 SPDT contacts, with taps for sensing lines to be connected to duct pressure fittings designed to sense air pressure. These fittings shall be of the angled-tip type with tips pointing into the air stream. Range shall be 0.5 to 6.0 inches water gauge (125 to 1490 Pa). Differential shall be a maximum of 0.15 inch water gauge (37Pa) at the low end of the range and 0.35 inch water gauge (87 Pa)at the high end of the range.

C. Pneumatic Electric (PE) Switches

Each switch shall have an adjustable setpoint range of 3 to 20 psig with a switching differential adjustable from 2 to 5 psig (14 to 34 kPa). The switch action shall be SPDT.

D. Solenoid-Operated Pneumatic (EP) Valves

Each valve shall have three-port operation: common, normally open, and normally closed. Each valve shall have an outer cast-aluminum body and internal parts of brass, bronze, or stainless steel. The air connection shall be a 3/8-inch (10mm) NPT threaded connection. Valves shall be rated for 50 psig (345 kPa) when used in a control system that operates at 25 psig (172 kPa)or less, or 150 psig (1034 kPa) when used in a control system that operates in the range of 25 to 100 psig (172 to 690 kPa).

2.10 INDICATING DEVICES

A. Thermometers

1. Piping System Thermometers
Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9-inch (229mm) scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

2. Piping System Thermometer Stems
   All thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.
   3. Non-Averaging Air-Duct Thermometers
      Air-duct thermometers shall have perforated stem guards and 45-degree (0.79 rad) adjustable duct flanges with locking mechanism.
   4. Averaging Air-Duct Thermometers
      Averaging thermometers shall have no less than 3-1/2 inch (89mm) dial, with black legend on white background, and pointer traveling through a 270-degree arc (4.7 rad).
   5. Accuracy
      Thermometers shall have an accuracy of plus or minus 1 percent of scale range. Thermometers shall have a range suitable for the application.

B. Pressure Gauges

Gauges shall be 2 inch (51mm) nominal size, back-connected, suitable for field or panel mounting as required, shall have black legend on white, background, and shall have a pointer traveling through a 270-degree (4.7 rad) arc. Accuracy shall be plus or minus 3 percent of scale range. Gauges shall meet requirements of ASME B40.1.

1. Pneumatic Actuator Gauges
   Gauges for indicating signal output to pneumatic actuators shall have an outer scale of 3 to 15 psig in 1-psig (21 to 103 kPa in 6.9 kPa) graduations.
2. Air-Storage Tank and Filter and Dryer Gauge
   Gauges for air-storage tanks and gauge for use before and after dirt-and-oil filters or dryers, shall have a scale of 0 to 60 psig with 2-psig graduations.
3. Hydronic-System Gauges

   Gauges for hydronic-system applications shall have ranges and graduations as shown.
4. Control Panel Main Air Gauge
   Panel mounted gauge for control system main air shall have a scale of 0 to 30 psig (0 to 207 kPa) with 1 psig (6.9 kPa) graduation.

C. Low Differential Pressure Gauges

Gauges for low differential-pressure measurements shall be 4-1/2 inch (115mm) nominal size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown.

Accuracy shall be plus or minus 2 percent of scale range.

2.11 SINGLE-LOOP CONTROLLERS

A. Controller Features

The controller shall be a microprocessor-based single-loop device that does not require Contractor-generated software. The controller shall meet CFR 47 Part 15, for Class A computing devices. The controller panel cutout shall be 3.62 inches by 3.62 inches (92mm x 92mm). The controller shall have field scalable process variable, a remote setpoint analog input and an analog output with adjustable high and low end limits and proportional control manual reset adjustment. The analog output shall result from proportional, integral and derivative (PID) control. The analog output shall be configurable as direct acting and reverse acting. The controller shall have keyboard, display, auto/manual selection for control of its analog output, remote setpoint adjustment/local setpoint adjustment selection with adjustable high-end and low-end limits, ratio and bias adjustments on remote setpoint input, operator-initiated self-tune/manual-tune selection, anti-reset wind-up feature, and 2 independent SPDT contact-closure outputs (PV alarm and PV deviation alarm). The controller shall be configurable to power-up in manual with local setpoint control, in automatic with local setpoint control and in automatic with remote setpoint control. The range of hysteresis adjustment shall be not smaller than from 1 percent to 5 percent of process variable input span. The controller shall power the analog output loop to 20 milliamperes when connected to a load of 600 ohms. The controller shall be capable of retransmitting the process variable to 20 milliamperes when connected to 600 ohms. The controller shall have 5-year battery backup to store operating parameters or shall have nonvolatile memory.

B. Parameter Input and Display

All control parameters shall be entered and displayed directly, in the correct engineering units, through a series of keystrokes on a front-panel display with a 3-1/2 digit, 7-segment display, with decimal point and polarity indication. The use of this display shall allow manual interrogation of setpoint, mode constants, and values of the process variable and output.

C. Controller Electrical Requirements

Each controller shall be powered by 120 volts ac. Power consumption shall not be greater than 20 watts. Each

controller shall provide electrical noise isolation between the ac power line and the process variable input, remote setpoint input, and output signals and of not less than 100 db at 60 Hz common-mode rejection ratio, and not less than 60 db at 60 Hz normal-mode rejection ratio.

D. Controller Accuracy

The controller shall have an accuracy of plus or minus 0.30 percent of input span, plus or minus 1 digit.

E. Self-Tuning

The controller self-tuning operation shall apply proportional, integral, and derivative modes of control and shall modify the mode constants as required. Self-tuning shall only be in operation when selected from the front panel.

F. Manual-Tuning

The controller manual-tuning operation shall provide proportional, integral, and derivative control modes, or any combination thereof, by means of individual mode constant adjustments. These adjustments shall be set for the appropriate value if a particular control mode action is desired, or to zero if that particular mode is not desired. The proportional-mode constant shall be adjustable from 0 to 200 percent of input signal range, the integral-mode constant shall be adjustable from 0 to 20 repeats per minute, and derivative-mode constant shall be adjustable from 0 to 5 minutes.

2.12 CONTROL DEVICES AND ACCESSORIES

A. Except where otherwise specified, control device and accessory input impedance shall not exceed 250 ohms.

B. Function Modules

Function modules shall accept mAdc analog input signals to produce mAdc analog output signals or contact output signals. Modules shall have zero and span adjustments for analog outputs, and setpoint adjustments for contact outputs. Module output span accuracy shall be plus or minus 1 percent of input span. Modules shall be rail-mounted as shown. Power consumption shall not be greater than 5 watts.

1. Minimum-Position Switch and Temperature-Setpoint Device
Minimum-position switch and temperature-setpoint device shall accept a 1000 ohms potentiometer input and shall

produce a steady analog output. In temperature setpoint applications the potentiometer shall be single-turn, suitable for wall mounting, enclosed in a locking metal or heavy duty plastic enclosure and shall have a graduated dial corresponding to the range of the setpoint adjustment. In a minimum position switch application the potentiometer shall be mounted on or internal to the minimum position switch. The device shall have its input signal electrically or optically isolated from output. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.

2. Signal-Inverter Modules
Signal inverter shall accept an analog input signal and shall have sufficient output capacity to drive the output signal through a circuit with an impedance of not less than 600 ohms. The output shall be electrically isolated from the input and the device shall have a moisture resistant coating. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.
3. High-Low Signal Selector
High-low signal-selector modules shall accept analog input signals and select either the highest or the lowest input signal as the output signal. The signal selector shall be powered by 120 Vac and the output signal shall be electrically isolated from the input signal.
4. Sequencer Modules
Sequencer modules shall provide fixed time-delayed sequencing of one or more contact transfers from an analog input signal. Sequencers shall return all contacts to their zero input signal condition when power is interrupted.
5. Loop Driver Modules
Loop driver module shall accept an analog input signal and shall have a circuit input impedance not greater than 100 ohms. The loop driver module shall have sufficient output capacity to drive the output signal through a circuit with an impedance range of not less than 1000 ohms. The output shall be electrically isolated from the input and the device shall have moisture resistant coating. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8 output signal.

C. Relays

Relays shall be 2-pole, double-throw (2PDT) with a 10-ampere resistive rating at 120 Vac, and shall have an enclosed 120-Vac coil with 8-pin blade connectors, and a matching rail-mounted socket. Power consumption shall not

be greater than 3 watts.

D. Time-Delay Relays

Time delay relays shall be 2PDT with 8-pin connectors, dust cover, and a matching rail-mounted socket. Adjustable timing range shall be 0 to 3 minutes. Power consumption shall not be greater than 3 watts.

E. Time Clocks

Each time clock shall be a 365-day programmable timing device with 4 independently timed circuits. Each clock shall have a manual scheduling keypad and an alphanumeric display of all timing parameters. Timing parameters shall include: date in Gregorian calendar for month, day and day-of-month indication; and 24-hour time-of-day display, with one-minute resolution for programming the ON and OFF times for each circuit. Each clock shall allow programming of each circuit for 12 holiday periods for either ON or OFF events for any selected duration of the 365-day program. Each clock shall have capacity for programming 4 ON events and 4 OFF events for each circuit. The programmed events shall be assignable to a 365-day schedule. Each clock shall have automatic Standard Time and Daylight Saving Time adjustment, by input of the appropriate dates. Each time clock shall have automatic leap year correction. Each clock shall be provided with 4-day battery backup. Power consumption shall not be greater than 10 watts.

F. Current-to-Pneumatic (IP) Transducers

The transducers shall be 2-wire current-to-pressure transmitters that convert a 4-to-20 mAdc input signal to a 3-15 psig (21 to 103 kPa), or a 15-3 psig (103 to 21 kPa), field-reversible pneumatic output, with a conversion accuracy of plus or minus 2 percent of full scale, including linearity and hysteresis. Input impedance shall not exceed 250 ohms. Air consumption shall not be greater than 0.25 scfm.

G. Regulated Power Supplies
Each power supply shall provide a 24-Vdc linear supply at not less than 2 amperes, with regulation to 0.05 percent of output voltage. Each power supply shall have a fused input, and shall be protected from voltage surges and power-line transients. The power supply output shall be protected against overvoltage and short circuits. Power supply shall be capable of providing power to a minimum of 25 VAV boxes. The power supply shall be rated at 1000VA.

H. Power Line Conditioner (PLC)

PLCs shall be furnished for each controller panel. The PLCs shall provide both voltage regulation and noise rejection. The PLCs shall be of the ferroresonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The PLCs shall be sized for 125 percent of the actual connected kva load. Characteristics of the PLC shall be as follows:

1. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal voltage when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal voltage.
2. During load changes of zero to full load, the output voltage shallnot deviate by more than plus or minus 3 percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.
3. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

2.13 PILOT LIGHTS AND MANUAL SWITCHES

A. Pilot lights and switches shall be rectangular devices arranged in a horizontal matrix as shown. Momentary switches shall be non-illuminated. Interlocking switches shall have separately illuminated sections. Device illumination shall be by light-emitting diode or neon lamp.

2.14 HVAC SYSTEM CONTROL PANELS

A. Panel Assembly

1. The panel shall be fabricated as shown, and the devices shall be mounted as shown. Each panel shall be fabricated as a bottom-entry connection point for control-system electric power, control-system main air source, control-system wiring, pneumatic tubing, interconnection of control systems and interconnection of starters and external shutdown devices. Each panel shall have an operating temperature rise of not greater than 20 degrees F (11 degrees C) above an ambient temperature of 100 degrees F (38 degrees C). The control panel shall be factory assembled and shipped to the job site as a single unit.

B. Panel Electrical Requirements

Each control panel shall be powered by nominal 120 volts ac terminating at the panel on terminal blocks. Instrument

cases shall be grounded. Interior panel, interior door, and exterior panel enclosure shall be grounded.

C. Enclosure

The enclosure for each panel shall be a NEMA 12 single-door wall-mounted box conforming to NEMA 250, with continuous hinged and gasketed exterior door with print pocket and key lock, continuous hinged interior door, interior back panel, and ventilation louvers in back surface as shown. Inside finish shall be white enamel, and outside finish shall be gray primer over phosphatized surfaces.

D. Mounting and Labeling

Controllers, pilot lights, switches, IP's, and pressure gauge shall be mounted on the interior door as shown. Power conditioner, fuses and duplex outlet shall be mounted on the interior of the cabinet as shown. All other components housed in the panel shall be mounted on the interior back panel surface of the enclosure, behind the door on rails as shown. Controllers and gauges shall be identified by a plastic or metal nameplate that is mechanically attached to the panel. The nameplate shall have the inscription as shown. Lettering shall be cut or stamped into the nameplate to a depth of not less than 1/64 inch (0.4mm), and shall show a contrasting color, produced by filling with enamel or lacquer or by the use of a laminated material. Painting of lettering directly on the surface of the interior door or panel is not permitted.

E. Wiring and Tubing

1. Current-to-Pneumatic Transducers (IP)
   Current-to-Pneumatic Transducers (IP) shall be piped to bulkhead fittings in the bottom of the panel with a 2-inch (51mm) loop to accommodate IP replacement and shall be wired to identified terminal blocks.
2. Wiring Interconnections
   Wiring shall be installed in wiring ducts in such a way that devices can be added or replaced without disturbing wiring that is not affected by the change. Wiring to all devices shall have a 4-inch (102mm) wiring loop in the horizontal wiring duct at each wiring connection. There shall be no wiring splices within the control panel. All interconnections required for power or signals shall be made on device terminals or panel terminal blocks, with not more than 2 wires connected to a terminal.
3. Terminal Blocks
   Terminal blocks shall be arranged in groups as shown. Instrument signal grounds at the same ground reference

level shall end at a grounding terminal for connection to a common ground point. Wiring-shield grounds at the same reference level shall end at a grounding terminal for connection to a common ground point. Grounding terminal blocks shall be identified by reference level.

4. Wiring Identification
All wiring connected to controllers, time clocks and function modules shall be identified by function and polarity with full word identifiers, i.e., process variable, input, remote setpoint input and control output.

2.15 COMPRESSED-AIR STATIONS

A. Air-Compressor Assembly

The air compressor shall be a high-pressure compressing unit with electric motor. The compressor shall be equipped with a motor with totally enclosed belt guard, and operating-pressure switch, safety-relief valves, gauges, intake filter and intake silencer, and combination-type magnetic starter with undervoltage protection and thermal-overload protection for each phase, and shall be supported by a steel base mounted on an air-storage tank. The air compressor shall provide the compressed air required for control operation while operating not more than one-third of the time. The air-storage tank shall be fabricated for a working pressure of not less than 200 psig (1380 kPa), and constructed and certified in accordance with ASME-16. The tank shall be of sufficient volume so that no more than six compressor starts per hour are required with the starting pressure switch differential set at 20 psig (138 kPa). The tank shall be provided with an automatic condensate drain trap with manual override feature. A second (duplex arrangement) compressor of capacity equal to the basic compressor shall be provided with interlocked control system to provide automatic changeover upon malfunction or failure of either compressor. A manual selector switch shall be provided to index the lead compressor including the automatic changeover.

B. Compressed-Air Station Specialties

1. Pressure Regulator, Filter and Refrigerated Dryer
A pressure regulator and refrigerated dryer shall be provided in the air outlet line of the air-storage tank. The dryer shall be of the size required for the full air-delivery capacity of the compressor. The air shall be dried at a pressure of not less than 70 psig (483 kPa) to a temperature not greater than 35 degrees F (2 degrees C). The dryer shall be provided with an

full air-delivery capacity of the compressor. The air shall be dried at a pressure of not less than 70 psig (483 kPa) to a temperature not greater than 35 degrees F (2 degrees C). The dryer shall be provided with an Pressure regulators of the relieving type are not acceptable at this location. Each filter shall be 100 percent efficient for particles down to 0.3 micrometer in diameter. Each filter bowl shall be rated for 150 psig (1034 kPa) maximum working pressure. A pressure regulator and safety valve shall beprovided downstream of the filter.

C. Flexible Pipe Connections

The flexible pipe connectors shall be designed for 150 psig (1034 kPa) and 250 degrees F (121 degrees C) service, and shall be constructed of rubber, tetrafluoroethylene resin, or braided corrosion-resistant steel, bronze, monel, or galvanized steel. The connectors shall be suitable for the service intended and may have threaded or soldered ends. The length of the connectors shall be as recommended by the manufacturer for the service intended.

1. Vibration-Isolation Units
The vibration-isolation units shall be standard products with published loading ratings, and shall be single rubber-in-shear, double rubber-in-shear, or spring type.

2.16 ELECTRONIC VARIABLE AIR VOLUME (VAV) TERMINAL UNIT CONTROLS

A. VAV Terminal Units
The VAV terminal units shall be as specified in Section 15930 Air Terminal Units.

1. Terminal-Unit Controls

a. Box Control Device
Controls for pressure-independent boxes shall consist of a velocity-sensing device in the primary air entering the box, a room temperature sensing element, a damper actuator, and an adjustable microprocessor-based VAV box controller. Each controller shall operate a damper for cooling and a duct coil for heating. Actuator shall open or close the device to which it is applied within 6 minutes. Terminal unit controls shall meet the requirements of UL 916 and CFR 47 Part 15.

2. Communication-and-Programming Device
Two hand-held communication-and-programming device with instruction manual, shall be provided. The

communication-and-programming device shall connect to the controller directly or to a jack at the room-temperature-sensing element location. The communication-and-programming device shall be used to read and set minimum velocity, maximum velocity, heating setpoint, and cooling setpoint, and to read velocity and space temperature.

2.17 MANUAL EMERGENCY FAN SHUTOFF SWITCHES

A. Manual emergency fan shutdown switches shall be provided for air distribution fan in accordance with NFPA 90A. Switches shall be the manual-reset type. Switches shall be located and mounted in an accessible manner, approximately 48 inches (1219 mm) above the finished floor. Switches shall be properly identified in etched rigid plastic placards.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION CRITERIA

A. The HVAC control system shall be completely installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control-system installation shall provide clearance for control-system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control-system devices. The control-system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

B. Device-Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturers' recommendations and as shown.

Control devices to be installed in piping and ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

C. Wiring Criteria
Wiring external to control panels, including low-voltage

wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and HVAC control panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Cables and conductors wires shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

D. Controller Output Loop Impedance Limitation

Controller output loops shall be constructed so that total circuit impedance connected to the analog output of a single-loop controller shall not exceed 600 ohms.

3.2 CONTROL-SYSTEM INSTALLATION

A. Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

B. Local Gauges for Actuators

Pneumatic actuators shall have an accessible and visible receiver gauge installed in the tubing lines at the actuator as shown.

C. Room-Instrument Mounting

Room instruments shall be mounted so that their sensing elements are 5 feet (1.5m) above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

D. Low-Temperature-Protection Thermostats

For each 20 square feet (1.8 square meters) of coil-face area, or fraction thereof, a thermostat shall be provided to sense the temperature at the location shown. The thermostat sensing element shall be installed in a serpentine pattern.

E. Averaging-Temperature Sensing Elements

Sensing elements shall have a total-element minimum length equal to one linear foot per square foot (3.3 linear meter per square meter) of duct cross-sectional area.

F. Foundations and Housekeeping Pads

Foundations and housekeeping pads shall be provided for the HVAC control-system air compressors.

G. Compressed-Air Stations

The air-compressor assembly shall be mounted on vibration eliminators, in accordance with ASME-16 for tank clearance. The air line shall be connected to the tank with a flexible pipe connector. Compressed-air-station specialties shall be installed with all required tubing, including condensate tubing to a floor drain.

H. Duct Static-Pressure Sensing Elements and Transmitters

The duct static-pressure sensing element and transmitter sensing point shall be located approximately two-thirds of the distance from the supply fan to the end of the duct with the greatest pressure drop.

I. Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

J. Tubing

1. Control System Installation
The control system shall be installed so that pneumatic lines are not exposed to outside-air temperatures. All tubes and tube bundles exposed to view shall be installed neatly in lines parallel to the lines of the building. Tubing between panels and actuators in mechanical/electrical spaces shall be routed so that the lines are easily traceable.
2. Pneumatic Lines In Mechanical/Electrical Spaces
In mechanical/electrical spaces, pneumatic lines shall be plastic tubing or copper tubing. Horizontal and vertical runs of plastic tubes or soft copper tubes shall be installed in raceways dedicated to tubing. The dedicated raceways shall be supported every 6 feet (1.8m) or horizontal runs and every 8 feet (2.4 m) for vertical runs. Tubing not installed in raceways shall be hard-drawn copper tubing with sweat fittings and

valves, supported every 6 feet (1.8 m) for horizontal runs and every 8 feet(2.4 m) for vertical runs.

3. Pneumatic Lines External To Mechanical/Electrical Spaces
   Tubing external to mechanical/electrical spaces, when run in plenum ceilings, shall be soft copper with sweat fittings, supported every 8 feet (2.4 m). Tubing not in plenum spaces shall be soft copper with sweat fittings supported every 8 feet (2.4 m) or shall be plastic tubing in raceways dedicated to tubing.
4. Connection to Liquid Lines
   Tubing for connection of sensing elements and transmitters to liquid and steam lines shall be copper with brass compression fittings.
5. Connection to Ductwork
   Tubing for connection of sensing elements and transmitters to ductwork shall be plastic tubing.
6. Tubing in Concrete
   Tubing in concrete shall be installed in rigid conduit. Tubing in walls containing insulation, fill, or other packing materials shall be installed in raceways dedicated to tubing.
7. Final Connection to Actuators
   Final connections to actuators shall be plastic tubing 12 inches (305mm) long and unsupported at the actuator.
8. Connection to HVAC Control Panel
   A manual valve shall be provided at each HVAC control panel to allow shutoff of main air. Pneumatic connections to HVAC control panels shall be made at bulkhead fittings. Final connections to HVAC control panel bulkhead fitting shall be exposed tubing approximately 12 inches (305mm) long.

K. Provide 2-way and 3-way chilled water control valves as indicated.

3.3 CONTROL SEQUENCES OF OPERATION

A. General Requirements

These requirements shall apply to all primary HVAC systems unless modified herein. The sequences describe the actions of the control system for one direction of change in the HVAC process analog variable, such as temperature, humidity or pressure. The reverse sequence shall occur when the direction of change is reversed.

B. Office Areas

1. AHU-1 through AHU-2 variable air volume units.

   a. Occupied Mode: The supply air fan and return fan

shall run continuously and be under static pressure control. The return air fan shall be under flow differential control. Fan speed (VFD) shall be modulated to maintain duct static pressure setpoint. Outdoor air damper shall be under mixed air temperature control and shall not close beyond minimum setting. Return and relief air dampers shall modulate in response to outdoor air damper occupancy mode shall be determined by time clock.

b. Unoccupied Mode: Supply air fan shall run continuously. Return air fan shall be stopped. Supply fan speed shall be modulated to maintain duct static pressure setpoint. Outdoor air damper and relief damper shall be closed. Return air damper shall be open.

c. Preheat coil control: The hot water control valves shall follow the following sequence.

   (1) When mixed air temperature is greater than 35 deg F, the hot water valve shall modulate to maintain coil discharge air temperature (55 deg F, adj.). On decrease in heating requirement, the hot water capacity valve shall modulate close.

   (2) When mixed air temperature is below 35 F, the hot water valve shall be fully open and the dampers shall modulate to maintain supply air temperature.

d. Upon activation of low limit freezestat, the supply and return fan shall stop, the outdoor air and relief dampers shall close and the return air damper shall fully open. Hot water valves shall fully open.

e. Cooling coil control: The chilled water valve shall modulate to maintain discharge air temperature (55 deg F, adj).

f. Humidifier Control: The humidifier steam valve shall modulate to maintain space air relative humidity (50%, adj.). Humidifier will be interlocked with the supply fan to prevent operation during times of no air flow.

g. Upon activation of the duct mounted smoke detectors, the supply fan shall stop, the return fan shall stop, outdoor air and relief air damper shall fully close, and return air damper shall

fully open.

h. Pressure-Independent Terminal VAV Box with Velocity All Modes - the control damper of the VAV box shall modulate in response to the signal from a flow-sensing element at the discharge or inlet of the VAV box to a microprocessor-based VAV-box velocity controller. The velocity controller shall control the box damper from the minimum-flow position to the full-flow position from the signal of a space-temperature sensing element located as shown. When the space temperature decreases, the damper shall gradually close to the minimum-flow position to maintain the cooling setpoint as shown. When the space temperature calls for heating after the minimum-flow position is reached, control shall then pass through a temperature dead band as shown. When the space temperature has dropped through the dead band, the duct heater coil shall be gradually controlled to maintain the heating setpoint as shown.

2. AHU-3 constant volume roof top unit.

a. The supply air and relief fan shall operate, outdoor air damper and relief damper shall be fully open, and return air damper shall be fully closed when assembly hall occupancy is detected. Occupancy shall be detected by an infrared occupancy sensor.

b. When assembly hall is unoccupied, outdoor air and relief damper shall be fully closed, return air damper shall be fully open, and supply air fan shall cycle to maintain space temperature. Relief fan shall stop.

c. When the heat is called for, the room thermostat opens the gas valve to provide full gas input to the burner. The non-electric modulating gas valve shall modulate to maintain a discharge air temperature of 85 deg. F.

d. Upon activation of low limit freezestat, the relief fan shall stop, the outdoor air and relief dampers shall close and the return air damper shall fully open. The gas valve shall provide full gas input to the burner and the supply fan shall cycle to maintain a 55 deg. F discharge temperature.

e. Cooling coil control: The chilled water valve shall modulate to maintain discharge air temperature (55

deg F, adj).

f. Humidifier Control: The humidifier shall modulate to space air relative humidity (90%, adj.). Humidifier will be interlocked with supply fan to prevent operation during times of no air flow.

g. Upon activation of the duct mounted smoke detectors, the supply fan and relief fan shall stop, return, relief, and outdoor air dampers shall fully close.

3. AHU-4 constant volume roof top unit.

a. Occupied Mode: The supply air fan and relief fan shall run continuously. Outdoor air and relief air dampers shall be fully open, return air damper shall be fully closed. Occupancy shall be sensed by an infrared occupancy sensor.

b. Unoccupied Mode: Outdoor air, return air, and relief air dampers shall be fully closed, and supply air fan shall not run.

c. When heat is called for, the room thermostat opens the gas valve to provide full gas input to the burner. The non-electric modulating gas valve shall modulate to maintain a discharge air temperature of 68 deg. F.

d. Upon activation of low limit freezestat, the supply and relief fan shall stop, the outdoor air and relief dampers shall close and the return air damper shall fully open. The gas valve shall provide full gas input to the burner.

e. Cooling coil control: The chilled water valve shall modulate to maintain discharge air temperature (75 deg F, adj).

f. Humidifier Control: The humidifier steam valve shall modulate to space air relative humidity (50%, adj.). Humidifier will be interlocked with supply fan to prevent operation during times of no air flow.

g. Upon activation of the duct mounted smoke detectors, the supply fan shall stop, return and outdoor air dampers shall fully close, and relief air damper shall fully open.

4. EF- ventilation fan control. Exhaust fans shall start

and associated louver shall open upon rise in space temperature above setpoint. On fall in space temperature below setpoint, exhaust fans shall stop and louver dampers shall close.

a. EF 1-3 shall operate when occupied as indicated by time clock.

b. EF-4 shall operate when energized by the hood switch.

c. EF-5-8 shall be operated when occupied as indicated by timeclock.

f. SF-1 shall be interlocked with the damper on GH-5, and shall be operated upon rise in space temp setpoint.

5. Mechanical space temperature control. UH-1 through UH-2.

a. Unit heater control (heating mode)

(1) Unit heaters shall be provided with dedicated thermostats. On fall in space temperature below setpoint, unit heater hot water valve shall modulate open and blower fan shall start. On rise in space temperature above setpoint, the reverse shall occur.

6. GFB-1, GFB-2 control

a. Hot water boilers shall be continuously enabled. Manufacturers packaged boiler controls shall modulate burner to maintain water temperature. Lead/lag operation of the boilers shall be provided by the manufacturers control package. Lead boiler shall be manually selectable from a local control panel and/or alternate weekly. Discharge water temperature shall be reset according to the following schedule:

Outdoor Air Temp	Setpoint
55 or less	180
Greater than 55	140

The damper on GH-5 shall open when burner is fired.

7. DWH-1 water heater control

a. Manufacturers packaged controls shall modulate hot

water valve to maintain tank water temperature.

8. ACCH-1, control

   a. Chiller shall be enabled any time that the outdoor air temperature is above 55 deg F. Manufacturers packaged controls shall modulate chillers to maintain chilled water temperature. Controls shall start and stop chilled water pumps and condenser water pumps for each chiller.

9. Fan Coils (FCU 1-9)

   a. Occupied/Unoccupied Mode: Fan shall be under control of room thermostat. Occupancy shall be sensed by an infrared occupancy sensor.

3.4 COMMISSIONING PROCEDURES

A. General Procedure

1. Evaluations
   The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, tune the controllers, set the clock schedule, and make any necessary control-system corrections to ensure that the systems function as described in the sequence of operation. The Contractor shall permanently record, on system equipment schedule, the final setting of controller proportional, integral and derivative constant settings, setpoint, manual reset setting, maximum and minimum controller output, and ratio and bias settings, in units and terminology specific to the controller.
2. Item Check
   An item-by-item check of the sequence of operation requirement shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shut down; Step 4 shall be performed after the HVAC systems have been started. Signals used to change the mode of operation shall originate from the actual HVAC control device intended for the purpose, such as the time clock. External input signals to the HVAC control panel (such starter auxiliary contacts, and external systems) may be simulated in Steps 1, 2, and 3. With each operational-mode change signal, Pilot lights and HVAC-panel output-relay contacts shall be observed to ensure that they function. All terminals shall be checked and observed to ensure that the proper signals are available.

3. Weather-Dependent Test Procedures
   Weather-dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the Contractor shall verify the actual results in the appropriate season.
4. Configuration
   The Contractor shall configure each controller for its specified service.
5. Two-Point Accuracy Check
   A two-point accuracy check of the calibration of each HVAC-control-system sensing element and transmitter shall be performed by comparing the HVAC- control-panel readout to the actual value of the variable measured at the sensing element and transmitter or air-flow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-controller readout accuracy. The calibration of the test instruments shall be traceable to NBS standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-controller readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.
6. Insertion, Immersion Temperature
   Insertion-temperature and immersion-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.
7. Averaging Temperature
   Averaging-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked every 2 feet (610 mm) along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.
8. Controller Stations
   The Contractor shall use the controllers' MANUAL/AUTOMATIC stations as the means of manipulating control devices, such as dampers and valves, to check IP operation and to effect stable conditions prior to making measurement checks.
9. Controller-Tuning Procedure
   The Contractor shall perform a controller-tuning procedure, which shall consist of setting the initial

proportional, integral, and derivative (PID) mode constants, controller setpoints, and logging the settings. Tuning shall be self-tuning operation by the controller unless manual tuning is necessary.

10. Controller Manual-Tuning Procedure
Where required, the controller manual-tuning procedure shall be performed in three steps. Using a constant-temperature-setpoint controller as an example, these steps are:

a. Step A:

(1) The controller MANUAL/AUTO station shall be indexed to the AUTO position and the integral- and derivative-mode constants set to zero.

(2) The proportional-mode constant shall be set to an initial setting of 8 percent. (This corresponds to 1.5 psig per degree F (10.3 kPa per 0.6 degree C) or 2.0 ma per degree F (4.4 degree C) proportional controller output change for a 100-degree F (55.6 degree C) transmitter span.) This causes the controller output signal to vary from live zero output to full output for an input signal change representing an 8-degree F change.

(3) Controllers for other variables, such as relative humidity and static pressure, shall have their proportional-mode constants set initially in a similar manner for an achievable output range proportional to the transmitter span.

b. Step B:

(1) The controller temperature setpoint shall be set at any achievable temperature. The controller output and transmitter input shall be observed.

(2) If the transmitter input continuously oscillates above and below the setpoint without settling at a fixed value, or if such oscillation increases, the proportional-mode constant is too small.

(3) If the proportional-mode constant is too small, increase it in steps until the transmitter input indicates stable control at any temperature, provided that the controller output is not at either extremeof the output range.

(4) If the temperature control point slowly drifts toward or away from the controller

setpoint, the proportional-mode constant is too large. Its setting shall be decreased in steps until oscillations occur as described in the preceding paragraphs, and then the setting shall be increased until stable control occurs.

(5) A step change in controller setpoint shall be introduced. This should cause the controller to overshoot the setpoint slightly, with each subsequent overshoot peak value decreasing by a factor of 2/3 until stable control is achieved at, above, or below the setpoint.

(6) Next, the integral-mode constant setting shall be increased in small steps, and setpoint changes shall be introduced until control point and controller setpoint coincide at stable control. This should happen consistently after a setpoint change within a short time, such as 5 to 10 minutes.

c. Step C:

(1) Unless the HVAC process variable changes rapidly, the derivative-mode constant setting can remain at zero.

(2) If derivative control is needed, the derivative-mode constant shall be gradually increased.

(3) Step changes in controller setpoint shall be introduced, and the derivative-mode constant setting adjusted until stable control is achieved.

11. Setting the Controller: After the controller manual-tuning procedure is complete, the controller shall be set at the setpoint as shown.

B. Unit Heater and Heating-Ventilating Unit: The "OFF/AUTO" switch shall be placed in the "OFF" position. Each space-thermostat temperature setting shall be turned up so that it makes contact and turns on the fans. The fans shall not start. The "OFF/AUTO" switch shall be placed in the "AUTO" position. It shall be ensured that the fans start. Verify Heating-Ventilating unit gas train ignition after fan starting. Each space-thermostat temperature setting shall be turned down, and the fans stop. All combustion processes shall also stop. The thermostats shall be set at their temperature setpoints as shown. The results of testing of one of each type of unit shall be logged.

C. All-Air Small Packaged Unitary (AHU-3, AHU-4): The schedules shall be manually entered for day-temperature and night-temperature setpoints as shown. The fan "AUTO/ON" switch shall be set to "ON". The time shall be manually entered as "DAY". The heating-cooling switch shall be raised to "HEATING" and it shall be ensured that cooling off. The temperature setpoint shall be raised and it shall be ensured that heating starts. The heating/cooling switch shall be set to "COOLING" and it shall be ensured that heat is off. The temperature setpoint shall be lowered and it shall be ensured that cooling starts. The fan "AUTO/ON" switch shall be set to "AUTO" and the foregoing procedure repeated. The fan shall start and stop automatically with the starting and stopping of heating and cooling. The time shall be manually entered as "NIGHT". The foregoing procedures shall be repeated. When the system is verified as operational, the correct "DAY" and "NIGHT" temperature settings shall be restore and the correct time restored. The power to the thermostat shall be shut off and it shall be verified that the thermostat clock keeps time. The results of testing of one of each type of unit shall be logged.

D. Hydronic Heating System:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. It shall be verified that power and main air are available at the HVAC system control panel.
b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature- sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air temperature and system-supply temperature shall be checked.
c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all valves shall be verified visually. The signal shall be varied from live zero of 4 ma or 3 psig (21 kPa) to 20 ma or 15 psig (103kPa), and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. Example: NC actuators are closed at 4 ma or 3 psig (21 kPa) and are open at 20 ma

or 15 psig (103kPa). The signal levels that move the controlled device to its extreme positions shall be logged.

d. Step 4 - Control-System Commissioning:

(1) The outside-air temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position and the two-point calibration sensing element-to-controller readout accuracy check for the outside-air temperature performed. The controller proportional band adjustment, the setpoint, the manual reset, and the maximum controller output shall be set to achieve the outside-air temperature schedule as shown.

(2) A signal shall be applied to simulate that the outside-air temperature is above the setpoint as shown. It shall be verified that the lead chiller is enabled and secondary chilled water pump operates. A signal shall be applied to simulate that the outside-air temperature is below the setpoint as shown. It shall be verified that the cooling system stops.

(3) The system's supply-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check of the sensing element-to-controller readout for the system-supply temperature performed. The controller shall be placed in the remote-setpoint mode. The remote setpoint for temperature schedule shall be set as shown. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller setup and tuning procedures performed. The controller shall be set at a system-supply temperature setpoint within the schedule as shown and the mode-constant setpoints logged. Signals of 8 ma and 16 ma shall be sent to the remote setpoint from the outside-air temperature controller, to verify that the controller setpoint changes to the appropriate values. The outside-air temperature controller's "MANUAL/AUTO" station shall be indexed to "AUTO."

(4) An occupied-mode signal shall be applied. Each space-temperature controller "MANUAL/AUTO" station shall be indexed to "MANUAL." The calibration accuracy check of sensing element-to-controller readout for each space temperature performed, and the values logged. The controller shall be placed in the remote-setpoint mode. Setpoint shall be set for 70 degrees F (21.1 degrees C) at midrange, 55 degrees F (12.8 degrees C) at the low end, and 85

degrees F (29.4 degrees C) at the high end. The proper action of the temperature-setpoint device at the space-temperature sensing element and transmitter location shall be verified. Each controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the controller-tuning procedure performed. An unoccupied-mode signal shall be applied and it shall be verified that the controller setpoint changes to the unoccupied-mode setting. The temperature setpoint device shall be set to the space-temperature setpoint as shown.

E. Variable-Air-Volume:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. The system shall be checked to see that power and main air are available at the HVAC system control panel, the outside-air and relief-air dampers are closed, the return-air damper is open, and cooling-coil valve are closed.

b. Step 2 - Calibration Accuracy Check with HVAC System in Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, mixed-air, and the cooling-coil discharge air temperatures shall be checked.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be visually verified. The signal shall be varied from live zero of 4 ma or 3 psig (21 kPa) to 20 ma or 15 psig (103 kPa), and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. Example: NC actuators are closed at 4 ma or 3 psig (21 kPa) and are open at 20 ma or 15 psig (103 kPa). The signal levels that move the controlled device to its extreme positions shall be logged.

d. Step 4 - Control-System Commissioning:

(1) The occupied-mode signalshall be applied, and it shall be verified that the occupied-mode pilot light turns on and Supply Fan starts. It shall be

verified that the outside-air damper and relief-damper are open, the return-air damper is open, and the cooling-coil valve and fan speed are under control, by slightly changing the controller output.

(2) The minimum-outside-air-mode signal shall be applied, and it shall be verified that the economizer pilot light is off. It shall be verified that the outside-air damper opens to its minimum position.

(3) With Supply Fan running, a high static-pressure input signal shall be simulated at the device, by pressure input to the differential-pressure switch sensing device. HVAC system shutdown shall be verified, it shall be verified that the high-static-pressure pilot light turns on, and contact output at EMCS terminals shall be verified. The differential-pressure switch shall be set at the setpoint as shown. The HVAC system shall be restarted by manual reset, and it shall be verified that the high static-pressure pilot light turns off.

(4) The supply-fan static-pressure controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check for sensing element-to-controller readout performed. The controller shall be placed in the local setpoint mode. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed. The controller shall be set at the static-pressure setpoint as shown, and the mode-constant setpoints logged.

(5) The mixed-air temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position. The controller output shall be changed to open the outside-air damper slightly, the two-point calibration accuracy check of the sensing element-to-controller readout for outside-air, return-air, and mixed-air temperatures performed. The temperature-controller "MANUAL/AUTO" switch shall be indexed to the "AUTO" position. The economizer-mode input signal shall be applied, and it shall be verified that the economizer-mode pilot light turns on. The controller-tuning procedure shall be performed. The controller shall be placed in the local setpoint mode, and set at the temperature setpoint as shown.

(6) The cooling-coil temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check of sensing element-to-controller

readout performed. The controller shall be placed in the remote-setpoint mode. The remote setpoint shall be set for plus 5-degree F (2.8 degree C) change from setpoint at 20-ma input, and minus 5-degree F (2.8 degree C) change from setpoint at 4-ma input. A 12-ma signal shall be sent to the remote setpoint for tuning at midrange. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed. Signals of 8 ma and 16 ma shall be sent to the remote setpoint to verify that the controller setpoint changes to the appropriate values. The controller shall be set in the local setpoint mode, and set at the temperature setpoint as shown.

(7) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode light turns off, and the control system assumes the specified shutdown conditions.

(8) With the HVAC system running, a filter differential-pressure-switch input signal shall be simulated at the device. It shall be verified that the filter pilot light turns on, and contact output at EMCS terminals shall be verified. The differential-pressure switch shall be set at the setpoint as shown.

(9) With the HVAC system running, a low-temperature-protection thermostat trip input signal shall be simulated, at the device. HVAC system shutdown shall be observed, it shall be verified that the low-temperature pilot light turns on, and contact output at EMCS terminals shall be verified. The thermostat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual reset, and it shall be verified that the pilot light turns off.

(10) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector, and control-device actions and interlock functions as described in the Sequence of Operation shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and the smoke-detector pilot light turns on, and contact output at EMCS terminals shall be verified. The detectors shall be reset. The HVAC system shall be restarted by manual reset, and it shall be verified that the pilot light turns off.

(11) Velocity setpoints shall be set for minimum and maximum flow and temperature setpoints for the heating/cooling dead band, for each VAV terminal

unit. The actions of the controller, the operation of the damper, and the operation of heating shall be verified. It shall be verified that space temperature is maintained.

3.5 TESTING, COMMISSIONING, AND BALANCING

A. Site Testing: The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing, calibration, adjusting and commissioning. The tests shall not be conducted during scheduled seasonal off-periods of base heating and cooling systems. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. The Contractor shall obtain written Government approval of the specific site-testing procedures prior to any test. Written notification of any planned site-testing, commissioning or tuning shall be given to the Government at least 14 calendar days prior to any test.
B. Control System Calibration, Adjustments, and Commissioning: All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Mechanical control devices shall be adjusted to operate as specified. Control system commissioning shall be performed for each HVAC system.
C. Performance Verification Test: The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on the Contractor's written certification of successful completion of Contractor site testing as specified.
D. Coordination with HVAC System Balancing: The Contractor shall tune the HVAC control system after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report has been issued. Commissioning, except for tuning of controllers, may be performed prior to or simultaneous with HVAC system balancing.
E. Posted Instructions: Instructions on 8-1/2-by-11-inch (216

mm by 279 mm)sheets and half-size plastic laminated drawings for each system, showing the final installed conditions, shall be placed in each HVAC control panel. The posted instructions shall include the control sequence, control schematic, ladder diagram, wiring diagram, valve schedules, damper schedules, panel arrangement drawings, commissioning procedures, controller configuration check sheet with final configuration record, preventive maintenance instructions and single-loop controller operators manual.

3.6 TRAINING

A. Training-Course Requirements: A training course shall be conducted for 5 operating staff members designated by the Contracting Officer. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. The Contractor shall be responsible for furnishing all audiovisual equipment and 5 sets of all other training materials and supplies. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. The Contractor shall submit an outline for the course, with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the start of the training.

B. Training-Course Content: For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each system-control device external to the panels, the location of the compressed-air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control-system performance by which to measure operation and maintenance effectiveness.

-- End of Section --

SECTION 15980

INSTRUMENTATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Positive displacement meters.

B. Flow meters.

C. Pressure gages and pressure gage taps.

D. Thermometers and thermometer wells.

E. Static pressure and filter gages.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 15510 - Hydronic Piping: Installation of thermometer wells and pressure gage tappings.

1.3 RELATED SECTIONS

A. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. ASME B40.1 - Gages - Pressure Indicating Dial Type - Elastic Element.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.

C. ASTM D2458 - Method of Flow Measurement by The Venturi Motor Tube.

D. ASTM E1 - Specification for ASTM Thermometers.

E. ASTM E77 - Verification and Calibration of Liquid-in-Glass Thermometers.

F. AWWA C700 - Cold Water Meters - Displacement Type.

G. AWWA C701 - Cold Water Meters - Turbine Type for Customer Service.

H. AWWA C702 - Cold Water Meters - Compound Type.

I. AWWA C706 - Direct Reading Remote Registration Systems for Cold Water Meters.

J. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

K. FS-GG-G-76 - Gages, Pressure and Vacuum, Dial Indicating (for Air, Steam, Oil, Water, Ammonia, Chloro-Flourhydrocarbon Gases, and Compressed Gases).

L. ISA RP 3.2 - Flange Mounted Sharp Edged Orifice Plates for Flow Measurement

M. UL 393 - Indicating Pressure Gages for Fire and Protection Services.

N. UL 404 - Gages, Indicating Pressure, for Compressed Gas Service.

1.5 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Product Data: For each type of meter, gage, and fitting specified, provide list which includes scale range, ratings, and calibrated performance curves, certified where indicated. Submit a meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.

B. Product Certificates: Provide product certificates signed by manufacturers of meters and gages certifying accuracies under specified operating conditions and compliance with specified requirements.

C. Maintenance Data: Maintenance Data shall be included in the "Operating and Maintenance Manuals" specified in Section 01000 and 15010.

D. Submit manufacturer's installation instructions under provisions of Section 01000 and 15010.

1.6 QUALITY ASSURANCE

A. Comply with applicable portions of American Society of Mechanical Engineers (ASME) and Instrument Society of America (ISA) Standards pertaining to Construction and Installation of Meters and Gages.

B. Design Criteria: The drawings indicate types, sizes, capacities, ranges, profiles, connections, and dimensional requirements of meters and gages and are based on the specific manufacturer types and models indicated. Meters

and gages having equal performance models indicated. Meters and gages having equal performance characteristics by other manufacturers may be considered, provided that deviations do not change the design concept or intended performance as judged by the Architect/Engineer. The burden of proof for equality of meters and gages is on the proposer.

1.7 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01000 and 15010.

B. Accurately record actual locations of instrumentation.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cole-Parmer Instrument Co.

B. H.O. Trerice Co.

C. Weiss Instruments

2.2 PRESSURE GAGES

A. ASME B40.1, FS-GG-G-76, 3-1/2 inch (89 mm) diameter drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background, one percent mid-scale accuracy, scale calibrated in both psi and kPa.

2.3 PRESSURE GAGE TAPS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psig (1034 kPa).

B. Needle Valve: Stainless Steel for maximum 200 psig.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch (6 mm) connections.

D. Syphon: Bronze, 1/4 inch (6 mm) angle or straight pattern.

2.4 STEM TYPE THERMOMETERS

A. ASTM E1, 9 inch (229 mm) scale, red appearing mercury, lens front tube, cast aluminum case with enamel finish and clear glass or polycarbonate window, brass stem, 2 percent of scale accuracy scale calibrated in both degrees F and degrees C.

2.5 DIAL THERMOMETERS

A. ASTM E1, 3-1/2 inch (89 mm) diameter dial in stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed Lexan lens, stainless steel stem, one percent of full scale accuracy, calibrated in both degrees F and degrees C.

2.6 THERMOMETER SUPPORTS

A. Thermometer Wells:
1. Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
2. Stem shall extend 2 inches (51 mm) into fluid.
3. Stem extension for insulated piping shall be 2 inches (51 mm) nominal, but not less than thickness of insulation.

B. Flange: 3 inch (76 mm) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.7 TEST PLUGS

A. Test Plug: 1/4 inch (6 mm) or 1/2 inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F (93 degrees C).

B. Test Kit: Carrying case, internally padded and fitted containing one 3-1/2 inch (89 mm) diameter pressure gages, one gage adapters with 1/8 inch (3 mm) probes, two 1-1/2 inch (38 mm) dial thermometers.

2.8 STATIC PRESSURE GAGES

A. 3-1/2 inch (89 mm) diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment with tubing, static pressure tips.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions for applications where used.

B. Install positive displacement meters with isolating valves on inlet and outlet. Provide full line size valved bypass with globe valve for liquid service meters.

C. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

D. Install pressure gages with pulsation dampers. Provide needle valve to isolate each gage.

E. Install thermometers in piping systems in wells in short couplings. Enlarge pipes smaller than 2-1/2 inch (64 mm) for installation of thermometer wells.

F. Install thermometers in air duct systems on flanges.

G. Install thermometer wells adjacent to controls system thermostat, transmitter, or sensor wells. Refer to Section 15950.

H. Locate duct mounted thermometers minimum 10 feet (3.05 m) downstream of mixing dampers, coils, or other devices causing air turbulence.

I. Coil and conceal excess capillary on remote element instruments.

J. Provide instruments with scale ranges selected according to service with largest appropriate scale.

K. Install gages and thermometers in locations where they are easily read from normal operating level.

L. Locate test plugs adjacent to control device wells.

M. Calibrate meters according to manufacturer's written instructions, after installation.

N. Adjust faces of meters and gages to proper angle for best visibility.

O. Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.2 POSITIVE DISPLACEMENT METER SCHEDULE

LOCATION OR SERVICE	SCALE RANGE
Expansion tank make-up	*Operating range of equipment used.

3.3 FLOW METER SCHEDULE

LOCATION OR SERIVCE	SCALE RANGE
Heating water system Chilled water system	*Operating range of equipment used

3.4 PRESSURE GAGE SCHEDULE

LOCATION OR SERVICE	SCALE RANGE
Pumps Expansion tanks	*Vacuum: 30 n.Hg(102kPa)vacuum 15psig(103kPa)pressure *Fluids Under Pressure 2 times operating pressure.
Chiller - Inlets and Outlets	

3.5 PRESSURE GAGE TAP SCHEDULE

LOCATION OR SERVICE	SCALE RANGE
Control valves 1 inch (25 mm) & larger - inlets and outlets	(See pressure gages)
Hot water heating coils - inlets and outlets	
Chiller - inlets and outlets	
Boilers - inlets and outlets	
Chilled Water Cooling Coils - inlets and outlets	

3.6 STEM TYPE THERMOMETER SCHEDULE

LOCATION OR SERVICE	SCALE RANGE
Boiler Feed Pump - inlets and outlets	30 to 300 deg. F, w/2 deg. F scale divisions (0 to 150 deg. C, w/ 1 deg. C scale divisions)
Chiller - inlets and outlets	0 to 100 deg. F, w/ 2 F scale divisions (-18 to 38 deg. C, w/1 C scale

divisions)

Domestic Cold Water Supply & Recirculation	0 to 100 deg. F, w/ 2 F scale divisions (-18 to 38 deg. C, w/1 C scale divisions)
Domestic Hot Water Supply & recirculation	30 to 240 deg. F, w/2 F scale divisions (0 to 115 deg. C, w/1 C scale divisions)
Hot Water Heating Coils	30 to 300 deg. F, w/2 F scale divisions (0 to 150 deg. C, w/ 1 C scale divisions)
Chilled Water Cooling Coil	0 to 100 deg. F, w/ 2 F scale divisions (-18 to 38 deg. C, w/1 C scale divisions)

3.7 THERMOMETER WELL SCHEDULE

LOCATION OR SERVICE	SCALE RANGE
Control Valves 1 inch (25mm) & larger - Inlets and outlets	(See thermometers)
Hot Water Reheat Coils - Inlets and Outlets	
Cabinet Heaters - Inlets and Outlets	
Hot Water Unit Heaters - Inlets and Outlets	

3.8 DIAL THERMOMETER SCHEDULE

LOCATION OR SERVICE	SCALE RANGE
Outside air	-30 to 130 deg. F, w/ 2 deg. F scale divisions (-35 to 55 deg. C, w/1 deg. C scale divisions)
Return air	0 to 100 deg. F, w/ 2 deg, F scale divisions (-18 to 38 deg. C, w/1 deg. C scale divisions)
Mixed air	0 to 100 deg. F, w/ 2 deg. F scale divisions (-18 to 38 deg. C, w/1 deg. C scale divisions)

Cooling Coil Discharge	0 to 100 deg. F, w/ 2 deg. F scale divisions (-18 to 38 deg. C, w/1 deg. C scale divisions)
Heating Coil Discharge	30 to 180 deg. F, w/ 2 deg. F scale divisions (0 to 83 deg. C, w/1 deg. C scale divisions)

3.9 STATIC PRESSURE AND FILTER GAGE SCHEDULE

LOCATION OR SERVICE	SCALE RANGE
Built up filter banks Unitary filter sections Supply fan discharge Building static	0.5 to 6.0 inches W.G. (124 Pa to 1493 Pa)

END OF SECTION

SECTION 15990

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

1.2 RELATED SECTIONS

A. Section 01440 - Contractor Quality Control: Testing laboratory services.

B. Section 01451 - Testing for Mechanical and Electrical Systems.

1.3 ALLOWANCES

A. Allowance includes testing, adjusting, and balancing of mechanical systems. Work is included in this section and is part of the Contract Sum/Price.

1.4 CODES AND STANDARDS
(Latest Edition or Revision)

A. AABC MN-1 - National Standards for Total System Balance.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. ANSI S1.4 - Sound Level Meters

D. ANSI S1.11 - Octave-Band and Fractional - Octave Band Analog and Digital Filters

E. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

F. CTI ATC-105 - Acceptance Test Code for Water-Cooling Towers.

G. NEBB-01 - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

H. NFPA90A - Installation of Air conditioning and Ventilating Systems.

I. SMACNA-07 - HVAC Systems Testing, Adjusting, and Balancing.

1.5 SUBMITTALS: Submit under provisions of Section 01300 and 15010.

A. Agency: Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.

B. Field Reports: Submit under provisions of Section 01000 and 15010.

1. Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

C. Data Reports: Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

D. Draft Reports: Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals. Submit 3 complete sets of draft report.

E. Final Reports: Submit final reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs for each appropriate section, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations. Provide schematic systems diagrams as required. Submit 6 complete sets of final report.

1. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

F. Test Reports: Indicate data on AABC National Standards for Total System Balance forms.

G. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01000 and 15010.

B. Record actual locations of balancing valves and rough setting.

1.7 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

B. Maintain one copy of document on site.

1.8 QUALIFICATIONS

A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer. The lead balancing technician's qualification data shall include past experience on at least five similar projects.

1.9 PRE-BALANCING CONFERENCE

A. One week) prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.10 SEQUENCING

A. Sequence work under the provisions of Section 01000 and 15010.

B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project. Systems shall be fully operational prior to beginning procedures.

C. Test, adjust, and balance the air systems before hydronic and refrigerant systems.

1.11 SCHEDULING

A. Schedule work under the provisions of Section 01000 and 15010.

B. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg F (2.8 deg C) wet-bulb temperature of maximum summer design condition, and within 10 deg F (5.6 deg C) dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus 10 percent and minus 5 percent of design for supply systems and plus 10 percent and minus 5 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus 10 percent and minus 5 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Following final acceptance of certified reports by the Contracting Officer, permanently mark settings of all valves, splitters, dampers, and other adjustment devices allowing settings to be restored if disturbed any time. Set and lock all memory stops.

C. The testing and balancing engineer shall permanently and legibly mark and identify the location points of the duct test ports. If the ductwork has exterior insulation, these markings shall be made on the exterior side of the ductwork insulation. All penetrations through ductwork and ductwork insulation shall be properly sealed to prevent air leakage or loss of vapor barrier.

D. After adjustment, take measurements to verify balance has not been disrupted, or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical

switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

G. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform the following steps.

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

3. Compare design to installed equipment and field installations.

4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

5. Check filters for cleanliness.

6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.

8. Determine best locations in main and branch ductwork for most accurate duct traverses.

9. Place outlet dampers in the full open position.

10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.

11. Lubricate all motors and bearings.

12. Check fan belt tension.

13. Check fan rotation.

3.6 AIR SYSTEM BALANCING PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes where required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

3.7 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

A. Before operating the system perform the following steps:

1. Open valves to full open position. Close coil bypass valves.

2. Remove and clean all strainers.

3. Examine hydronic systems and determine if water has been treated and cleaned.

4. Check pump rotation.

5. Clean and set automatic fill valves for required system pressure.

6. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.

7. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).

8. Set temperature controls so all coils are calling for full flow.

9. Check operation of automatic bypass valves.

10. Check and set operating temperatures of chillers to design requirements.

11. Lubricate all motors and bearings.

3.8 HYDRONIC SYSTEM BALANCING PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.9 SPECIFIC SYSTEMS

A. Where specific systems require special or additional procedures for testing and balancing, such procedures shall be in accordance with the standard selected in paragraph GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide-open terminals shall be used to meet the design water flow.

1. Primary-Secondary: Primary-secondary systems shall be treated as separate systems. Primary systems shall be balanced first with the secondary systems running. Secondary systems shall then be balanced.

2. Summer-Winter: Summer-winter systems shall be balanced in the summer mode of operation. Following completion of the summer-mode balancing, equipment used for winter operation shall be balanced.

3.10 SOUND LEVEL TESTING

A. After the systems are properly tested, adjusted and balanced, sound levels shall be checked in accordance with the applicable provisions of AABC MN-1. Octave-band analysis and noise-criteria curve data shall be recorded on forms shown in AABC MN-1. All occupied areas including offices, corridors, auditorium and meeting rooms shall be verified to be within the sound levels shown or as specified. Any areas not meeting the requirements of AABC MN-1 or the specifications or drawings shall be clearly indicated n the form and an explanation of all discrepancies shall be provided in test report.

3.11 CONTROL SYSTEMS

A. Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding

with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

3.12 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing shall include, and shall not be limited to the following:

1. Electric Water Coolers
2. Plumbing Pumps
3. HVAC Pumps
4. Forced Air Furnaces
5. Direct Fired Furnaces
6. Rotary Water Chillers
7. Induced Draft Cooling Tower
8. Air Cooled Refrigerant Condensers
9. Terminal Heat Transfer Units
10. Air Handling Units
11. Fans
12. Air Filters
13. Air Terminal Units
14. Air Inlets and Outlets
15. Controls Compressor
16. Vehicle Exhaust Systems
17. Infrared Radiant Heating Systems
18. Kitchen Exhaust Hood and Makeup Air Systems (including fire suppression systems)
19. Scullery Exhaust Hood Systems

B. Report Forms

1. Title Page:

a) Name of Testing, Adjusting, and Balancing Agency
b) Address of Testing, Adjusting, and Balancing Agency
c) Telephone number of Testing, Adjusting, and Balancing Agency
d) Project name
e) Project location
f) Project Architect
g) Project Engineer
h) Project Contractor
i) Project altitude
j) Report date

2. Summary Comments:

a) Design versus final performance
b) Notable characteristics of system
c) Description of systems operation sequence
d) Summary of outdoor and exhaust flows to indicate

amount of building pressurization
e) Nomenclature used throughout report
f) Test conditions

3. Instrument List:

a) Instrument
b) Manufacturer
c) Model number
d) Serial number
e) Range
f) Calibration date

4. Electric Motors:

a) Manufacturer
b) Model/Frame
c) HP/BHP
d) Phase, voltage, amperage; nameplate, actual, no load
e) RPM
f) Service factor
g) Starter size, rating, heater elements
h) Sheave Make/Size/Bore

5. V-Belt Drive:

a) Identification/location
b) Required driven RPM
c) Driven sheave, diameter and RPM
d) Belt, size and quantity
e) Motor sheave diameter and RPM
f) Center to center distance, maximum, minimum, and actual

6. Pump Data:

a) Identification/number
b) Manufacturer
c) Size/model
d) Impeller
e) Service
f) Design flow rate, pressure drop, BHP
g) Actual flow rate, pressure drop, BHP
h) Discharge pressure
i) Suction pressure
j) Total operating head pressure
k) Shut off, discharge and suction pressures
l) Shut off, total head pressure

7. Combustion Test:

a) Boiler manufacturer
b) Model number
c) Serial number
d) Firing rate
e) Overfire draft
f) Gas meter timing dial size
g) Gas meter time per revolution
h) Gas pressure at meter outlet
i) Gas flow rate
j) Heat input
k) Burner manifold gas pressure
l) Percent carbon monoxide (CO)
m) Percent carbon dioxide (CO2)
n) Percent oxygen (O2)
o) Percent excess air
p) Flue gas temperature at outlet
q) Ambient temperature
r) Net stack temperature
s) Percent stack loss
t) Percent combustion efficiency
u) Heat output

8. Air Cooled Condenser:

a) Identification/number
b) Location
c) Manufacturer
d) Model number
e) Serial number
f) Entering DB air temperature, design and actual
g) Leaving DB air temperature, design and actual
h) Number of compressors

9. Chillers:

a) Identification/number
b) Manufacturer
c) Capacity
d) Model number
e) Serial number
f) Evaporator entering water temperature, design and actual
g) Evaporator leaving water temperature, design and actual
h) Evaporator pressure drop, design and actual
i) Evaporator water flow rate, design and actual
j) Condenser entering air temperature, design and actual

10. Cooling Coil Data:

a) Identification/number

b) Location
c) Service
d) Manufacturer
e) Air flow, design and actual
f) Entering air DB temperature, design and actual
g) Entering air WB temperature, design and actual
h) Leaving air DB temperature, design and actual
i) Leaving air WB temperature, design and actual
j) Water flow, design and actual
k) Water pressure drop, design and actual
l) Entering water temperature, design and actual
m) Leaving water temperature, design and actual
n) Saturated suction temperature, design and actual
o) Air pressure drop, design and actual

11. Heating Coil Data:

a) Identification/number
b) Location
c) Service
d) Manufacturer
e) Air flow, design and actual
f) Water flow, design and actual
g) Water pressure drop, design and actual
h) Entering water temperature, design and actual
i) Leaving water temperature, design and actual
j) Entering air temperature, design and actual
k) Leaving air temperature, design and actual
l) Air pressure drop, design and actual

12. Air Moving Equipment

a) Location
b) Manufacturer
c) Model number
d) Serial number
e) Arrangement/Class/Discharge
f) Air flow, specified and actual
g) Return air flow, specified and actual
h) Outside air flow, specified and actual
i) Total static pressure (total external), specified and actual
j) Inlet pressure
k) Discharge pressure
l) Sheave Make/Size/Bore
m) Number of Belts/Make/Size
n) Fan RPM

13. Return Air/Outside Air Data:

a) Identification/location
b) Design air flow

c) Actual air flow
d) Design return air flow
e) Actual return air flow
f) Design outside air flow
g) Actual outside air flow
h) Return air temperature
i) Outside air temperature
j) Required mixed air temperature
k) Actual mixed air temperature
l) Design outside/return air ratio
m) Actual outside/return air ratio

14. Exhaust Fan Data:

a) Location
b) Manufacturer
c) Model number
d) Serial number
e) Air flow, specified and actual
f) Total static pressure (total external), specified and actual
g) Inlet pressure
h) Discharge pressure
i) Sheave Make/Size/Bore
j) Number of Belts/Make/Size
k) Fan RPM

15. Duct Traverse:

a) System zone/branch
b) Duct size
c) Area
d) Design velocity
e) Design air flow
f) Test velocity
g) Test air flow
h) Duct static pressure
i) Air temperature
j) Air correction factor

16. Duct Leak Test:

a) Description of ductwork under test
b) Duct design operating pressure
c) Duct design test static pressure
d) Duct capacity, air flow
e) Maximum allowable leakage duct capacity times leak factor
f) Test apparatus

1. Blower
2. Orifice, tube size

3. Orifice size
4. Calibrated

g) Test static pressure
h) Test orifice differential pressure
i) Leakage

17. Air Monitoring Station Data:

a) Identification/location
b) System
c) Size
d) Area
e) Design velocity
f) Design air flow
g) Test velocity
h) Test air flow

18. Flow Measuring Station:

a) Identification/number
b) Location
c) Size
d) Manufacturer
e) Model number
f) Serial number
g) Design Flow rate
h) Design pressure drop
i) Actual/final pressure drop
j) Actual/final flow rate
k) Station calibrated setting

19. Terminal Unit Data:

a) Manufacturer
b) Type, constant, variable, single, dual duct
c) Identification/number
d) Location
e) Model number
f) Size
g) Minimum static pressure
h) Minimum design air flow
i) Maximum design air flow
j) Maximum actual air flow
k) Inlet static pressure

20. Air Distribution Test Sheet:

a) Air terminal number
b) Room number/location
c) Terminal type
d) Terminal size
e) Area factor

f) Design velocity
g) Design air flow
h) Test (final) velocity
i) Test (final) air flow
j) Percent of design air flow

21. Sound Level Report:

a) Location
b) Octave bands - equipment off
c) Octave bands - equipment on

22. Vibration Test:

a) Location of points:

1. Fan bearing, drive end
2. Fan bearing, opposite end
3. Motor bearing, center (if applicable)
4. Motor bearing, drive end
5. Motor bearing, opposite end
6. Casing (bottom or top)
7. Casing (side)
8. Duct after flexible connection (discharge)
9. Duct after flexible connection (suction)

b) Test readings:

1. Horizontal, velocity and displacement
2. Vertical, velocity and displacement
3. Axial, velocity and displacement

c) Normally acceptable readings, velocity and acceleration
d) Unusual conditions at time of test
e) Vibration source (if non-complying)

END OF SECTION

SECTION 16010

GENERAL PROVISIONS, ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Basic electrical requirements that are applicable to all Division 16 Sections in addition to Division 0 - Contract Requirements and Division 1 - General Requirements.

1.2 RELATED SECTIONS

A. DIVISION 0 - CONTRACT REQUIREMENTS.

B. DIVISION 1 - GENERAL REQUIREMENTS.

C. DIVISION 15 - MECHANICAL

1.3 CONTRACTOR'S RESPONSIBILITY:

A. Refer to Section 01140.

1.4 CODES AND STANDARDS

A. All work shall be manufactured, installed and labeled in accordance with the applicable provisions of the latest editions of the following codes and standards, including Addendums and modifications made by local authorities.

1. NFC - National Fire Code
2. NEC - National Electrical Code
3. SBC - Standard Building Code
4. SFPC - Standard Fire Prevention Code
5. UBC - Uniform Building Code
6. BOCA Basic National Building Code - Building Officials and Code Administrators International, Inc.
7. NESC - National Electrical Safety Code
8. NECA - National Electrical Contractors Association
9. UL - Underwriters Laboratories
10. NEMA - National Electrical Manufacturers Association
11. OSHA - Occupational Safety and Health Act
12. Local codes and ordinances
13. IEEE - Institute of Electrical & Electronic Engineers
14. Equipment manufacturer's Published Instructions
15. Other applicable codes and standards specified in other sections hereinafter.

B. Where the contract documents exceed the code or standard requirements, the Contract Documents shall take precedence.

C. All electrical materials shall be listed by Underwriters' Laboratory (UL), and shall be so labeled where UL labeling is customary.

1.5 ACCURACY OF DATA AND DRAWINGS:

A. Drawings and Data: Electrical drawings are generally diagrammatic, and where not dimensioned or detailed, indicate approximate locations and general arrangements of electrical work. Exact conduit routing, offsets, risers, junction boxes, pull boxes, and fittings are not necessarily shown; however, provide these as required by the conditions involved and applicable codes for a correct and complete installation. Provide all inserts, anchors, supports and sleeves as required.

B. The indicated branch circuit conduit routings are intended to show the required circuitry from panelboards to outlets, fixtures and other devices. However, if necessitated by job conditions, deviations from the indicated routings may be made, provided that regardless of the actual installed arrangement of the conduits: each outlet marked with the same circuit number is connected to the same corresponding numbered circuit; outlets are switched and controlled as indicated; and no home run is brought into any switch box unless otherwise indicated.

C. Major equipment items such as panelboards, transformers, control panels, etc. are drawn to scale using nominal dimensions based on information of one of the major manufacturer's of the item. The Contractor shall inform prospective equipment suppliers of any space limitations associated with the locations of the equipment and verify that their equipment will or will not fit in the space indicated on the drawings. Proper clearances in front of and around equipment and required for working and cooling shall be maintained as indicated or required by applicable codes or equipment manufacturer's requirements. If there are any conflicts, the Contractor shall notify the Resident Officer In Charge before the project Bid Date.

D. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND STRUCTURAL DRAWINGS.

E. Equipment NOT furnished by Electrical Section but requiring electrical connections: from other sections and others furnishing this equipment, determine exact electrical connection requirements therefore. Locations and arrangements of electrical connections indicated for this equipment are APPROXIMATE ONLY. Refer to Section 16180.

1.6 SUBMITTALS: Submittals shall be provided to the Engineer as described in Section 01300.

A. All Devices: Submittals shall be made for all wire, conduit, equipment and devices described in this specification. See appropriate section for detailed information to be included in the submittal.

1.7 GROUNDING:

A. Ground electrical equipment and conductors as required by NEC and other applicable electrical codes. Refer to Section 16170.

1.8 TYPE OF SYSTEM, WIRING METHOD:

A. Electrical system characteristics: Voltages and amperages shall be as indicated.

B. Regardless of voltage or use, install wiring in conduits and metal or other enclosures, unless otherwise indicated or otherwise specified.

PART 2 PRODUCTS

2.1 HOUSEKEEPING PADS

A. Provide 4" high concrete pads for all floor mounted electrical equipment such as transformers, large distribution panels, etc. The pad dimensions shall be approximately 2 inches larger than the equipment in the width and depth dimensions. Bevel the edges of the pad to reduce chipping. Refer to Section 03300 for concrete specifications.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION:

A. Copies of applicable equipment manufacturer's installation drawings and instructions shall be kept on site.

3.2 TESTS, INSPECTIONS, ADJUSTMENTS AND CLEANUP:

A. Furnish suitable testing equipment, give the Resident Officer in Charge and all applicable authorities ample advance notice of all proposed tests and readiness of work for observations, and conduct each test in their presence, as approved. Do not conceal electrical work until all necessary observations have been made and all required

tests have been approved by the Engineer and all applicable authorities.

B. Put entire electrical system in operation, test all equipment, remedy all defects and make all necessary adjustments. Demonstrate that the entire system functions satisfactorily, as specified, as indicated and as approved.

C. Clean all electrical work thoroughly. Remove foreign matter which has accumulated in all fixtures, equipment, and enclosures. Clean all fixture glassware and reflectors and clean and polish all other surfaces that are not to be painted so that they present a new and acceptable appearance. Manufacturer's cleaning instructions shall be followed if applicable. Any finished surfaces that are scratched or marred shall be touched up or refinished with materials approved by the manufacturer.

3.3 PROTECTION AND CLEANING:

A. Work shall be protected at all times. Conduit openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered, if necessary, to protect against dirt, water, chemical or mechanical damage or defacement.

3.4 OPERATING INSTRUCTIONS:

A. Furnish the services of a competent person (or persons) to instruct the Owner's personnel in the proper operation and maintenance of all equipment, for each system installed.

B. Furnish and deliver to the User operation and maintenance manuals for all equipment installed under this contract.

3.5 AS-BUILT DRAWINGS:

A. The Contractor shall provide as-built drawings.

3.6 GUARANTEE:

A. The Contractor shall guarantee all work.

END OF SECTION

SECTION 16111

CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rigid metal conduit.

B. Intermediate metal conduit.

C. Flexible metal conduit.

D. Liquidtight flexible metal conduit.

E. Electrical metallic tubing.

F. Rigid PVC conduit.

G. Fittings and conduit bodies.

1.2 RELATED SECTIONS

A. Division 0 - Contract Requirements.

B. Division 1 - General Requirements.

C. Section 07270 - Fire Stopping.

D. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

E. Section 16010 - General Provisions - Electrical

F. Section 16170 - Grounding and Bonding.

G. Section 16180 - Equipment Wiring Systems.

H. Section 16190 - Supporting Devices.

I. Section 16191 - Seismic Restraint Systems.

J. Section 16195 - Electrical Identification.

1.3 CODES AND STANDARDS

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI C80.6: Intermediate Metal Conduit (IMC).

D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

E. ANSI/NFPA 70 - National Electrical Code.

F. NECA "Standard of Installation."

G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

H. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

J. UL 1: Flexible Metal Conduit.

K. UL 6: Rigid Metal Conduit.

L. UL 360: Liquidtight Flexible Steel Conduit.

M. UL 514B: Fittings for Conduit and Outlet Boxes.

N. UL 651: Schedule 40 and 80 Rigid PVC Conduit.

O. UL 797: Electrical Metallic Tubing.

P. UL 1242: Intermediate Metal Conduit.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information for each type of conduit, conduit body, fitting and attachment device.

1. Conduit

a. Type of material
b. Thickness of material
c. Types of protective coatings on the outside and inside.
d. Type of protective coating on threads, if applicable.

2. Conduit Bodies

a. Type of material
b. Type of cover material
c. Type of protective coatings; interior and

exterior.
d. Type of material for screws and gaskets.

3. Conduit Fittings

a. Type of materials such as bodies, gaskets, seals, etc.
b. Threaded
c. Compression or set screw type
d. Liquid tight
e. Concrete tight

1.5 PROJECT RECORD DOCUMENTS

A. Record the actual routing of all feeder conduits to switchboards, panelboards, etc. and all underground conduit or conduit concealed in or under the slab in contact with the ground. Indicate the location of junction and pull boxes and sealing fittings and expansion fittings in these conduits. Dimension the locations of conduits, boxes and fittings on the drawings referenced from the exterior walls, columns or corners of the building. Record any modifications, deletions or additions to the branch circuitry indicated on the original drawings.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL label.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. The threads of rigid steel and IMC shall be protected by factory installed caps.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:

1. Allied
2. LTV Steel Tubular Products Co.
3. Triangle
4. Wheatland
5. Substitutions: Approved equal.

B. Rigid Steel Conduit (RSC): RSC shall be threaded, hot dip galvanized inside and outside with a chromate coating outside. Threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.

C. Intermediate Metal Conduit (IMC): IMC shall be threaded, hot-dip or electro-galvanized outside with chromate coating. The inside shall be galvanized or coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth, low friction surface. The threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.

D. Couplings: Couplings shall be threaded, hot-dip or electro-galvanized steel with chromate coating and made by the same manufacturer as the conduit.

2.2 PVC COATED METAL CONDUIT

A. Manufacturers:

1. Robroy, Inc.
2. OCAL
3. Perma-Cote Industries

B. Description: Conduit shall be rigid steel, hot-dip galvanized inside and outside including the threads. The exterior surface shall be treated prior to coating. Both interior and exterior shall be coated with an apoxy acrylic primer. The exterior shall be coated with a minimum 40 mil thick PVC coating. The interior shall be coated with a nominal 2 mil thick urethane coating. The conduit shall be bendable without damage to either the PVC or urethane coating. The threads shall be coated with a nominal 2 mil thick clear urethane coating. Elbows and nipples shall conform to the same specification.

C. Couplings, Fittings and Conduit Bodies:

1. Couplings shall be galvanized steel and made by the same manufacturer as the conduit.
2. Fittings shall be malleable iron or steel.
3. Conduit bodies shall be copper free cast aluminum or malleable iron with cast covers and stainless steel screws.

4. All couplings, conduit fittings and conduit bodies shall have the same exterior and interior coatings as specified for the conduit.
5. Threads shall have the same 2 mil (.005 mm) clear urethane coating as specified for the conduit.
6. The exterior PVC material shall form a sleeve extending one pipe diameter or 2", whichever is less, from each female opening of couplings, fittings and conduit bodies.
7. Clamps, U-bolts, and other devices used to secure the conduit shall be malleable iron or steel with the same PVC coating as the conduit.
8. Couplings, fittings and conduit bodies shall be of the same manufacturer as the conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. AFC
2. Alflex Corp.
3. Anamet, Inc.
4. Electri-Flex Co.
5. Substitutions: Approved equal.

B. Description: Interlocked galvanized steel.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. AFC
2. Alflex
3. Anamet Inc.
4. Carol
4. Electri-Flex Co.
5. Spiraduct
6 Substitutions: Approved equal.

B. Description: Interlocked galvanized steel with extruded PVC jacket.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube and Conduit.
2. LTV Steel Tubular Products Co.
3. Triangle PWC Inc.
4 Wheatland Tube Co.
5 Substitutions: Approved equal.

B. Description: EMT shall be hot-dip or electro-galvanized on the outside with a chromate coating. The interior shall be coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth low friction surface.

2.6 NONMETALLIC CONDUIT

A. Manufacturers:

1. Carlon
2. Can-Tex Industries
3. Georgia Pipe
4. Substitutions: Approved equal.

B. Description: PVC; Schedule 40 and 80 PVC as indicated or specified.

C. Fittings: Fittings shall match conduit type and material and shall be provided by the same manufacturer as the conduit.

D. Cement for connections of conduit and fittings shall be approved by the manufacturer of the conduit.

2.7 FITTINGS AND CONDUIT BODIES FOR METAL, EMT AND FLEXIBLE CONDUIT

A. Fittings

1. Manufacturers:

a. Appleton
b. Crouse-Hinds
c. Raco
d. O.Z./Gedney
e. Midwest Electric
f. Steel City
g. Thomas and Betts

Substitutions: Approved equal.

2. Description:
   a. All fittings, locknuts, bushings, etc. shall be malleable iron or steel.
   b. For RSC or IMC, fittings shall be threaded type.
   c. For EMT, fittings shall be compression or set screw type.
   d. Locknuts shall have shape edges that bite into the enclosure when tightened.
   e. Bushings shall be high temperature plastic, with insulating throats and grounding lugs where applicable.

f. Hub fittings shall be two-piece, liquid-tight with high temperature, plastic, insulating throats.
g. Fittings used in concrete shall be UL Listed as concrete tight.
h. Fittings used in exterior and other damp or wet applications shall be UL Listed as liquid tight.
i. Fittings for flexible metal conduit have insulated throats and grounding lugs where applicable.
j. Refer to the PVC coated metal conduit and nonmetallic conduit specifications for fittings used with those types of conduit.
k. Sealing bushings shall have molded neoprene sealing ring with predrilled holes for each conductor, PVC coated pressure discs, stainless steel screws and washers and locking ring where applicable.

B. Conduit Bodies:

1. Manufacturers:

a. Appleton
b. Crouse-Hinds
c. O-Z/Gedney
d. Midwest Electric
e. Steel City
f. Raco
g. Killark
h. Substitutions: Approved equal.

2. Description: Conduit bodies shall be malleable iron or cast copper-free aluminum. They shall be threaded type with cast cover and solid gasket. Where used in dry interior applications, provide coated steel screws. Where used in exterior or other damp or wet applications, use stainless steel screws. Conduit bodies 1-1/4 inches and larger shall have rollers or wire guards.

C. Expansion fittings:

1. Manufacturers:

a. Appleton
b. Crouse-Hinds
c. O.Z./Gedney
d. Substitutions: Approved equal.

2. Description: These shall be malleable iron or steel with insulator bushing, gaskets, washers, packing, etc. as required to provide a complete unit. Provide a braided copper bonding jumper. The fitting shall be

rated for interior or exterior use as applicable.

D. Seal Fittings:

1. Manufacturers

a. Appleton
b. Crouse-Hinds
c. O.Z./Gedney
d. Substitutions: Approved equal.

2. Description: Seal fittings shall be malleable iron or cast aluminum, threaded type with, packing, sealing compound, plugs, etc. to provide a complete unit. Fittings shall be rated for interior or exterior use as applicable.

E. Deflection Fittings

1. Manufacturers

a. Appleton
b. Crouse-Hinds
c. O.Z./Gedney
d. Substitutions: Approved equal.

2. Description: Deflection fittings shall be hot-dip galvanized ductile iron, threaded type with molded neoprene outer jacket, tinned braided copper bonding jumper, molded plastic inter sleeve, stainless steel clamping bands, etc. to provide a complete unit. The fitting shall be rated for interior or exterior use as applicable. Where fittings are used below grade, they shall be PVC coated as specified under PVC coated metal conduit fittings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Outdoor Locations, Above Grade: Use rigid steel and intermediate metal conduit.

B. Wet and Damp Locations: Use rigid steel conduit, intermediate metal conduit, and rigid nonmetallic conduit.

C. Dry Locations:

1. Concealed in concrete or masonry construction above grade, columns, walls and above suspended ceilings: Use rigid steel conduit, intermediate metal conduit,

and electrical metallic tubing.
2. Exposed: use rigid steel, intermediate metal conduit, and electrical metallic tubing.

D. Locations Subject to Physical Damage: Use rigid steel conduit or intermediate metal conduit.

E. Flexible Metal Conduit: Flexible metal conduit shall be installed for:

1. Connections from the conduit system to recessed lighting fixtures, maximum 6 feet in length.
2. Connections to motors, maximum 2 feet in length.
3. Connections to electrical equipment subject to movement or vibration.

F. Liquid-Tight Flexible Metal Conduit: Liquid-tight flexible metal conduit shall be installed for:

1. Connections to motor or equipment subject to movement or vibration where exposed to rain, spray, or a corrosive atmosphere.
2. Connections to equipment subject to oil or grease.

G. General Requirements:

1. Install conduit in accordance with NECA "Standard of Installation" and manufacturer's written instructions.
2. Install nonmetallic conduit in accordance with manufacturer's instructions.
3. Minimum Size: 1/2 unless otherwise specified.
4. Field measurements: Refer to 16010.
5. Verify routing and termination requirements and locations of conduit prior to rough-in.
6. Routing and termination of conduits shall be coordinated with structural, equipment, piping and ductwork to assure accessibility to junction and pull boxes.
7. Conduit routing shown on the drawings is diagramatic unless otherwise dimensioned. Route conduit as specified and as required. Conduit offsets, risers, junction boxes, pull boxes, and fittings are not necessarily shown; however, provide these as required by the conditions involved and applicable codes for a correct and complete installation.
8. Finished Areas: Conceal conduits below floors, within slabs only where indicated, within walls, within pipe chases, above suspended ceilings, and within other building construction, unless otherwise indicated. Conduits shall not be run in floor slabs except where otherwise indicated.
9. Unfinished Areas: Install above-floor conduits

exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms, storage areas, and other unfinished areas.

10. Install conduits run exposed or concealed above ceilings or in walls in straight, level and plumb lines, parallel with and at right angles with beams, wall, ceilings and other building lines.
11. Route conduit in slabs above grade and in and under slabs on grade from point-to-point or shortest practical path.
12. All individual suspended conduits (2-1/2" or larger) and all trapeze hangers where hanger rods are over 12 inches in length from the point of attachment to the structure, shall be provided with seismic sway bracing. Conduits shall not be supported from the ceiling hanger wires or ceiling tee bars except for short runs of up to 3/4" branch circuit conduits which run from a wall or structural member and terminate in an outlet box mounted in or on the ceiling. Conduits supported on the ceiling tees shall be supported on the main runners only. A maximum of two 3/4" conduits may be supported from any single hanger wire and attached only in the upper and lower 12" of the hanger wire. Conduits shall not be run across and secured directly to the ceiling tee bar system that will prohibit the raising and removal of the ceiling tile. Additional hanger wires may be provided as conduit supports. These wires shall be the same size as the ceiling support wires and shall be attached to the ceiling grid and the structure above. They shall be tight without deforming the ceiling grid.
13. Arrange supports to prevent misalignment during wiring installation.
14. Support individual conduit using coated steel or malleable one hole conduit straps, lay-in adjustable hangers, clevis hangers, threaded rods with conduit fasteners and split hangers.
15. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits. Each conduit shall be independently attached to the rack.
16. Fasten conduit supports to building structure and surfaces under provisions of Section 16190. Do not fasten conduit supports to mechanical piping or ducts or their supports.
17. Do not support conduit with tie wire or perforated pipe straps. Remove wire used for temporary supports
18. Do not cross conduits in slab.
19. Conduit shall be installed a minimum of 12 inches from steam or hot water piping, flues or any other surface with a surface temperature exceeding 104 degrees F (40

degrees C) run in parallel with the conduit, and a minimum of 6 inches where run perpendicular to the conduit. Conduit shall be installed a minimum of 3 inches from cold or chilled water piping.

20. Cut conduit square using saw or pipecutter; ream and de-burr cut ends.
21. Bring conduit to shoulder of fittings; fasten wrench-tight.
22. When threads are cut in rigid steel or intermediate metal conduit in the field, the conduit and fittings shall be made up immediately. If there are any threads showing, they shall be coated with a corrosion resistant compound approved by the conduit manufacturer.
23. When threads are cut in PVC coated rigid steel conduit in the field, the threads shall be coated immediately with a corrosion resistant compound supplied by the conduit manufacturer. When the PVC coating of the conduit is removed or damaged for any reason, the exposed area shall be coated with a PVC compound supplied by the conduit manufacturer. Follow the manufacturer's instructions in applying compounds.
24. Solvent weld nonmetallic conduit and fittings using cement as approved by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure as instructed by the manufacturer.
25. Use conduit hubs or water tight fittings to fasten conduit to metal boxes in damp and wet locations.
26. Install no more than equivalent of three 90-degree bends between pull or outlet boxes. Make field-made bends and offsets with hickey or conduit bending machine. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch size. Do not install crushed or deformed conduits. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. For banked runs, all bends and offsets shall be parallel.
27. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
28. Provide approved adapters when PVC conduits are coupled to metallic conduits.
29. Provide approved fittings that maintain conduit electrical continuity by bonding jumpers or other means to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
30. Provide seal fittings on all conduits where they rise out of the ground or fill below slabs. If the conduit terminates in a floor mounted metal enclosure such as a switchboard, pull box, etc., provide a sealing

bushing as specified with a grounding bushing.

31. Provide seal fittings on all conduits that penetrate exterior walls to or from interior spaces or other areas where conduit passes from one extreme temperature or moisture situation to another.
32. Install a pull line in each empty conduit except sleeves and nipples in which wire or cable is to be installed by others if the conduit is more than 50 feet in length and contains more than the equivalent of two 90 degree bends or where the conduit is more than 150 feet in length. Pull lines shall be monofilament plastic having a minimum 200-pound tensile strength. Leave a minimum of 12 inches of slack at each end of the pull line.
33. Where conduits rise through floor slabs, curved portions of bends shall not be visible above the finished slab.
34. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms.
35. Support horizontal and vertical runs of conduit at intervals in accordance with the code for the types of conduit used. In addition, support each riser conduit at each building floor level.
36. Prior to wire pulling, use suitable caps to protect installed conduit against entrance of dirt and moisture and blow out or swab out conduits in which moisture or dirt has collected. Free clogged conduits of obstructions.
37. Ground and bond conduit under provisions of Section 16170.
38. Identify conduit under provisions of Section 16195.
39. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction where conduit and other electrical items are not installed prior to concrete placing or masonry laying. Sleeves through concrete walls, concrete columns, and concrete beams shall be IPS steel pipe or rigid steel conduit, flush with finished concrete surfaces. Sleeves for all conduits passing through the floor shall be galvanized IPS pipe or galvanized rigid steel conduit extending two inches above finished floor, and flush with slab below.
40. Install conduit to preserve fire and smoke resistance rating of partitions, floors and other elements.
41. Route conduit through suitable roof flashing devices.
42. Provide insulating bushings on all feeder conduits.
43. Provide code size pull boxes, in accessible locations, in all conduits where the number and degree of bends exceed the code limitations and every 150 feet (45 m) maximum for long straight runs.
44. All conduits that are stubbed out below grade shall

have a threaded, watertight cap installed on the end.

45. Individual and grouped conduits suspended above accessible ceilings shall be located a sufficient distance above the ceiling to permit the removal of the ceiling tile.
46. Conduits shall be located so as not to hinder access to mechanical and electrical equipment through the ceiling tiles.
47. Exposed suspended conduits shall be located as to provide proper headroom as required by O.S.H.A. regulations.
48. Conduit runs shall be complete before conductors are installed in them.

END OF SECTION

SECTION 16114

CABLE TRAYS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cable trays and accessories.

1.2 CODES AND STANDARDS

A. ANSI/NFPA 70 - National Electrical Code.

B. ASTM A 123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.

C. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process.

D. NEMA VE 1 - Metallic Cable Tray Systems.

1.3 SUBMITTALS

A. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.

B. Product Data: Provide data for fittings and accessories.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 PROJECT RECORD DOCUMENTS

A. Record actual routing of cable tray and locations of supports.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Square D.

B. B-Line.

C. Substitutions: Approved Equal.

2.2 LADDER-TYPE CABLE TRAY

A. Description: NEMA VE 1, Class 20C ladder type tray.

B. Material: Steel.

C. Finish: ASTM A 123, hot dipped galvanized after fabrication. Painted with gray epoxy.

D. Inside Width: 12 inches.

E. Inside Depth: 6 inches.

F. Straight Section Rung Spacing: 9 inches on center.

G. Inside Radius of Fittings: 24 inches.

H. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

2.3 WARNING SIGNS

A. Engraved Nameplates: 1/2 inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install metallic cable tray in accordance with NEMA VE 1.

C. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 8 ft maximum.

D. Use expansion connectors where required.

E. Ground and bond cable tray under provisions of Section 16170.
   1. Provide continuity between tray components.
   2. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.
   3. Connections to tray may be made using mechanical or exothermic connectors.

F. Install warning signs at 50 ft centers along cable tray, located to be visible.

END OF SECTION

SECTION 16115

INDOOR SERVICE POLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Indoor service poles.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical.

B. Section 16111 - Conduit.

C. Section 16123 - Building Wire and Cable.

D. Section 16130 - Boxes.

E. Section 16140 - Wiring Devices.

F. Section 16170 - Grounding and Bonding.

G. Section 16180 - Equipment Wiring Systems

H. Section 16741 - Interior Telephone and Data Pathways and Wiring.

1.3 CODES AND STANDARDS

A. ANSI/NFPA 70 - National Electrical Code.

B. NEMA WD 6 - Wiring Device Configurations.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Product Data: Indicate materials, finishes, receptacle and connector configuration, and attachment details.

B. Manufacturer's Instructions: Indicate storage, handling, protection, examination, preparation and installation procedures.

1.5 RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual locations of indoor service poles and circuits to them.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Include submittal data sheets and manufacturer's installation instructions.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the service poles specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL label.

1.10 PROJECT CONDITIONS

A. Make field measurements to determine service pole length.

B. Locations of indoor service poles shown on Drawings are approximate unless dimensioned. Determine actual furniture arrangement and locate poles as required to accommodate furniture layout.

1.11 COORDINATION

A. Coordinate work with telephone cable installer.

B. Coordinate work with data communications cable installer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AFC

B. Dual-Lite

C. Hubbell

D. Walker

E. Wiremold

F. Substitutions: Approved equal.

2.2 DESCRIPTION

A. Main Body: Extruded Aluminum with 2 separate compartments; one for power and one for telephone and/or data cabling.

B. Cover Plates: Aluminum.

C. The cross-section dimensions shall be approximately 2-3/4 inches by 3 inches total. 2-3/4 inches by 1-1/2 inches for power side and 2-3/4 inches by 1-1/2 inches for data side. The length shall be as required for the service pole to span from the floor to the ceiling.

D. Foot: Suitable for carpet or hard surface floor finish as indicated.

E. Provide concealed top clamp to fasten pole to inverted "T" grid ceiling suspension member. Fasten to main runners only and secure to the runners with sheet metal screws.

F. Provide trim plate for ceiling opening.

G. Provide a junction box with metal divider attached to the top of the pole above the ceiling for power and communication wire entry to the pole.

H. Provide knockout for connection of 2-1 inch conduits at top of pole, one for power, one for data. Provide insulating fitting or bushing.

I. Finish: Ivory.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install poles plumb.

C. Make wiring connections to branch circuit outlets using flexible conduit under provisions of Section 16111.

D. Bond equipment grounding conductor and body of pole to

branch circuit equipment grounding conductor.

E. Neatly cut openings in ceiling panels. Install trim plate.

END OF SECTION

SECTION 16123

BUILDING WIRE AND CABLE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Building wire and cable.

B. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions, - Electrical.

B. Section 16111 - Conduit.

C. Section 16115 - Indoor Service Poles.

D. Section 16130 - Boxes.

E. Section 16170 - Grounding and Bonding

F. Section 16180 - Equipment Wiring Systems.

G. Section 16195 - Identification.

1.3 CODES AND STANDARDS

A. NECA - Standard of Installation

B. NEMA WC 5 - Thermoplastic - Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

C. NEMA WC 26 - Wire and Cable Packaging.

D. NFPA 70 - National Electrical Code.

E. UL 83 - Thermoplastic - Insulated Wires and Cables.

F. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

G. UL 510 - Insulating Tape.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different type of wire and connector. The information shall be in the form of manufacturer's

standard data sheets or drawings.

1. Wire and Cable

    a. Conductor material
    b. Conductor gage or MCM
    c. Solid or stranded conductor
    d. Insulation material
    e. Insulation type designation
    f. Insulation temperature rating.

2. Wiring Connectors

    a. Connector Type
    b. Connector material
    c. Voltage, amperage and temperature ratings
    d. Conductor size ranges
    e. Tools required
    f. Picture of connector and tools
    g. Manufacturers installation instructions

3. Heat Shrink Material

    a. Type of material
    b. Wall thickness
    c. Voltage, and temperature ratings
    d. Conductor size ranges
    e. Tools required
    f. Picture of material and tools
    g. Manufacturer's installation instructions

4. Insulating Tape

    a. Type of material
    b. Thickness and width

5. Wire Pulling Lubricants

    a. Type of material
    b. Types of conductor, insulation and conduit for which it is approved.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Codes and Standards.

1.5 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual wire and cable sizes on riser or single line

diagrams or floor plans. Record actual circuit numbers by fixture and devices and on circuit homeruns.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with codes and standards listed in Section 16010.

B. Wire shall be manufactured within 12 months prior to the date of delivery to the site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacturing of the products specified in this section with minimum three years documented experience.

1.8 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets on wire, cable, all connectors and accessories.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 PROJECT CONDITIONS

A. Conductor sizes are based on 60 Degree C copper up to #1 AWG and 75 deg. C copper over #1 AWG, unless otherwise indicated.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.11 COORDINATION

A. Coordinate wire and cable sizes with actual installed equipment.

PART 2 PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Manufacturers
1. American Electric
2. Capitol Wire and Cable
3. Condumex Inc.
4. Diamond Wire
5. General Cable
6. Southwire
7. Triangle Wire
8. Approved equal.

B. BUILDING WIRE AND CABLE

1. Description: Single conductor insulated wire.

2. Conductor: Copper; 98 percent conductivity; solid for 10 AWG or smaller; stranded for larger than 10 AWG as applicable.

3. Insulation Thermoplastic; 600 volts, NFPA 70, Type THW TW THHN/THWN unless otherwise indicated; 75 degree C or 90 degree C.

4. All building wire shall be of the same manufacturer. Do not mix wire of different manufacturer on the same project.

5. Identification

a. General: All wires shall be identified as required by NEC.
b. The insulation on wiring #8 or smaller shall have factory-colored insulation. For wire larger than #8, color coding shall be colored tape wrapped around the insulation of each wire at each connection, splice and pull box. Each phase conductor of each branch circuit shall be of one color throughout the installation.
c. Color coding shall be as follows:

1) 480/277 volt; three phase system:
Phase A - Brown
Phase B - Orange
Phase C - Yellow
Neutral - Gray
Ground - Green
Isolated Ground - Green/Yellow
2) 208/120 volt, three phase system:
Phase A - Black

Phase B - Red
Phase C - Blue
Neutral - White
Ground - Green
Isolated Ground - Green/Yellow

3) 240/120 volt, three phase, 4 wire, delta system:
Phase A - Black
Phase B - Orange
Phase C - Blue
Neutral - White
Ground - Green
Isolated Ground - Green/Yellow

C. CONTROL WIRE

1. Description: Single conductor insulated wire.
2. Conductor: Copper; stranded for all sizes.
3. Insulation: Thermoplastic; 600, NFPA 70 Type MTW unless otherwise indicated; 75 degree C or 90 degree C as applicable.
4. All control wire shall be of the same manufacturer.
5. Identification: Control wire shall be color coded throughout. Each wire shall be identifeid at each terminal and junction point by permanently attached wire markers indicating the terminal number, etc. Refer to Section 16195.

2.2 WIRING CONNECTORS

A. Solderless Spring-Wire Connectors: Tool-Applied, twist-on type with plastic caps; Rated for conductor sizes and material.

1. Manufacturers

a. Buchanan-"B-Cap"
b. Ideal- "Wing Nut"
c. ITT Blackburn-"Free Spring"
d. 3M - "Scotchlok"
e. Panduit - "P-Conn"
f. Thomas & Betts "Piggy"
g. Approved equal.

B. Compression Connectors and Taps: Mechanical set screw type or tool-applied crimp type. Split bolt connectors are not acceptable.

1. Manufacturers
a. Blackburn
b. Buchanan
c. Burndy

d. Ilsco
e. Ideal
f. Thomas & Betts
g. Approved equal.

2.3 ACCESSORIES

A. Heat Shrink Material: heavy wall tubing or caps; UL Listed as waterproof.

1. Manufacturers
a. Ideal
b. Panduit
c. Raychem
d. 3M
e. Thomas & Betts
f. Approved equal.

B. Insulating Tape: Vinyl type; minimum 7 mil; listed for use as primary insulation and splice jacketing on 600 volt wire and cable.

1. Manufacturers
a. Plymouth - Premium III
b. 3M - Scotch 33+
c. Approved equal.

C. Wire Pulling Lubricants: Compatible with all conductor, insulation and conduit types.

1. Manufacturers

a. American Polywater
b. Buchanan
c. Condux
d. CRC Chemicals
e. Ideal
f. Madison
g. Approved equal.

PART 3 EXECUTION

3.1 PREPARATION

A. Completely and thoroughly swab raceway where moisture and/or dirt has collected inside before installing wire.

B. Do not install wire in conduit, raceways, etc. until they are complete and sealed against the entry of moisture and/or debris.

3.2 WIRING METHODS

A. Concealed Dry Interior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.

B. Exposed Dry Interior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.

C. Above Accessible Ceilings: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.

D. Wet or Damp Interior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.

E. Exterior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.

F. Remote control, alarm and signal circuits: Type MTW insulation in raceway.

G. Use wiring methods in accordance with the appropriate article of NFPA 70.

H. Connect each circuit of a multi-circuit home run to a different phase.

I. Do not terminate more than one conductor in a single terminal of a lug or connector.

J. Leave slack conductor at each connection and splice to allow for future additional connections.

3.3 INSTALLATION

A. Install products in accordance with the codes and standards herebefore specified and manufacturers instructions.

B. Install all wiring in raceways unless otherwise indicated.

C. Use conductor not smaller than 12 AWG for power and lighting circuits.

D. Use conductor not smaller than 14 AWG for control circuits.

E. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet to the furthest outlet.

F. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet to the furthest fixture.

G. Pull all conductors into raceway at same time.

H. Use suitable wire pulling lubricant.

I. Use a pulling means such as tape, rope, grips, etc. that will not damage the wire, cable or conduit.

J. Neatly train and lace wiring inside boxes, equipment, cabinets, switchboards, and panelboards with nylon tie straps. Three phase circuits shall be grouped by circuit.

K. Clean conductor surfaces before installing lugs and connectors.

L. Make splices,taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

M. Tighten set screws and bolts on connectors according to the manufacturer's torquing requirements.

N. Use compression connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of the conductor.

O. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 16195.

B. Refer to Section 16130 for identification of contents of pull and junction boxes.

C. In pull or junction boxes where there is more than one circuit, identify each conductor with its circuit number or other designation indicated on Drawings.

3.5 WIRING TEST

A. Measure the insulation resistance of all feeder conductors using a "Megger". The test voltage shall be 500 volts. Test the conductor without circuit loads applied. The minimum resistance value shall be 1,000,000 ohms.

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

END OF SECTION

SECTION 16130

BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Floor boxes.

C. Pull and junction boxes.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 16010 - General Provisions - Electrical.

C. Section 16111 - Conduit.

D. Section 16123 - Building Wire and Cable.

E. Section 16140 - Wiring Devices.

F. Section 16170 - Grounding and Bonding.

G. Section 16180 - Equipment Wiring Systems.

H. Section 16190 - Supporting Systems.

I. Section 16195 - Electrical Identification.

J. Section 16721 - Fire Alarm System.

K. Section 16741 - Interior Telephone and Data, Pathways and Wiring.

1.3 CODES AND STANDARDS

A. NECA - Standard of Installation.

B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

C. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NFPA 70 - National Electrical Code.

F. UL 514A - Metallic Outlet Boxes, Electrical.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different type of outlet, floor, pull and junction box. The information shall be in the form of manufacturer's standard data sheet or drawings or shop drawings.

1. Box material
2. Wall or sheet metal thickness
3. Dimensions
4. Hub or knockout sizes
5. Gasket material
6. Cover plate material and thickness
7. Picture of the box.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual sizes and locations of pull, and junction boxes in feeders. Dimension the location in reference to column lines and exterior walls.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Data: Submittal data sheets or drawings.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standard listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the U.L. Label.

1.10 PROJECT CONDITIONS

A. Verify locations of floor boxes and outlets prior to rough-in.

B. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

C. Refer to Sections 16010 and 16180.

PART 2 PRODUCTS

2.1 OUTLET BOXES

A. Manufacturers
1. Appleton
2. Crouse-Hinds
3. Killark
4. O-Z/Gedney
5. Raco
6. Steel City
7. Thepitt
8. Approved equal.

B. Sheet Metal Outlet Boxes: galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include male fixture studs where required.
2. Boxes cast in concrete not in contact with earth: Concrete type.

C. Cast Boxes: Type FD cast malleable iron or copper-free aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

D. Wall Plates: Refer to Section 16140.

2.2 PULL AND JUNCTION BOXES

A. Manufacturers
1. Appleton
2. Crouse Hinds
3. Hoffman
4. Hope
5. Keystone
6. O-Z/Gedney
7. Queen
8. Approved equal.

B. Sheet Metal Boxes: NEMA 1, unless noted otherwise, galvanized steel.

C. Hinged Enclosures: Refer to Section 16160.

D. Surface-Mounted Cast Metal Box: NEMA, Type 4; flat-flanged, surface-mounted junction box.

1. Material: Galvanized cast iron or cast aluminum.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install boxes in accordance with NECA Standard of Installation and appropriate article of NFPA 70.

B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. Inaccessible Ceiling Areas: Install outlet, pull and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07270.

G. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

H. Use flush mounting outlet boxes in finished areas.

I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic and fire rated walls.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Use stamped steel bridges to fasten flush mounting outlet box between studs.

L. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

M. Use adjustable steel channel fasteners for hung ceiling outlet box. Channel fasteners shall be attached to the main runners or supports. The fastener shall be secured to the tee bar or ceiling support with a screw run thru the tee bar or support and the fastener at each point at which it is attached.

N. Do not fasten boxes to ceiling support wires.

O. Support boxes to or from the structure independent of conduit, except cast outlet boxes that are connected to two rigid metal conduits both supported within 12 inches of box.

P. Use gang box where more than one device is mounted together. Do not use sectional box.

Q. Use gang box with plaster ring for single device outlets.

R. Use cast outlet box in exterior locations exposed to the weather and wet locations.

S. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

T. Set floor boxes level.

U. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.

1. Interior Dry Locations: Use box with hinged cover or enclosure under provisions of Section 16160.
2. Other Locations: Use surface-mounted cast metal box.

V. All pull boxes and junction boxes shall be identified as to their contents. Boxes for power feeder and branch circuit wiring shall indicate the circuit numbers. Boxes for communication and control wiring shall indicate the system or what the wiring is for. The identification shall be written on the cover in bold characters using a wide tip, black, permanent marker.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment furnished under other Sections. Refer to Section 16180.

B. Coordinate locations and sizes of required access doors with Section 08305.

C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

D. Coordinate mounting heights of outlet boxes with the device mounting heights indicated on the drawings.

E. Orient boxes to accommodate wiring device orientation.

F. Align adjacent wall mounted boxes for switches, thermostats and similar devices.

G. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

H. Position outlet boxes to locate light fixtures as shown on reflected ceiling plan.

I. Coordinate with architectural, structural and mechanical so that boxes will be accessible.

J. Provide access panels for junction or pull boxes above inaccessible ceilings or in chases.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

3.4 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish where scratched or marred.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Device plates and box covers.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions

B. Section 16115 - Indoor Service Poles

C. Section 16123 - Building Wire and Cable

D. Section 16130 - Boxes

E. Section 16170 - Grounding and Bonding

F. Section 16180 - Equipment Wiring Systems

G. SEction 16195 - Electrical Identification

1.3 CODES AND STANDARDS

A. NECA - Standard of Installation.

B. NEMA WD 1 - General Requirements for Wiring Devices.

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements.

D. NFPA 70 - National Electrical Code.

E. UL 20 - General-use Snap Switches

F. UL 498 - Attachment Plugs and Receptacles

G. UL 943 - Ground-Fault Circuit Interrupters

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different device. The information shall be in the form of manufacturer's standard data sheets.

1. Wall switches:

a. Grade
b. Number of poles
c. 3 or 4 way
d. Body and handle material
e. Color of handle
f. Voltage rating
g. Ampere rating
h. Dimensioned picture of the swtich

2. Wall Dimmers:

a. Type of circuitry of dimming, RFI filtering and voltage compensation.
b. On-off switch
c. Slide control
d. Materials for dimmer, plates, etc.
e. Color
f. Voltage rating
g. Wattage rating
h. Dimensioned picture for the dimmer

3. Receptacles

a. Grade
b. Number of poles and wires
c. Grounding type
d. Material for body and face
e. NEMA configuration
f. Voltage rating
g. Amperage rating
h. Dimensioned picture of the receptacle

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the devices.

1.5 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record the location of all devices and the actual circuits to which they are connected.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated. Products shall bear the UL Label.

1.10 FIELD MEASUREMENTS

A. The locations of devices indicated on the drawings are approximate. Coordinate the exact location with millwork and equipment.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
1. Bryant 4900 Series
2. Hubbell 1220 Series
3. Arrow-Hart 1990 Series
4. Approved equal.

B. Description: Specification Grade, AC only general-use snap switch; single or double pole, 3 or 4 way as indicated.

C. Body and Handle: plastic with toggle handle. Handle color as indicated.

D. Ratings:

1. Voltage: 120-277 volts, AC.
2. Current: 20 amperes.

2.2 20A DUPLEX RECEPTACLES

A. Manufacturers:

1. Bryant - 5262 Series
2. Hubbell - 5262 Series
3. Arrow-Hart - 5262 Series
4. Approved equal.

B. Description: Specification Grade, 2 pole, 3 wire, grounding type duplex receptacle.

C. Device Body: plastic with nylon face. Color as indicated.

D. Configuration: NEMA 5-20R.

E. Ratings:
1. 125 volts AC
2. 20 Amperes

2.3 GROUND FAULT INTERRUPTER RECEPTACLES

A. Manufacturers:

1. Arrow-Hart - GF 5342 Series
2. Bryant - GFR 53FT Series
3. Hubbell - 5362 Series
4. Approved equal.

B. Description: Specification Grade, 2 pole, 3 wire, grounding type, duplex receptacle, 5 ma sensitivity, feed thru type, test and reset buttons.

C. Device Body: Plastic with plastic or nylon face. Color as indicated.

D. Configuration: NEMA 5-20R

E. Ratings

1. 125 volts AC
2. 20 Amperes

2.4 20A SINGLE RECEPTACLE, 125V

A. Manufacturers:
1. Arrow-Hart - 5361
2. Bryant - 5361
3. Hubbell - 5361
4. Approved equal.

B. Description: Specification Grade, 2 pole, 3 wire, grounding type, simplex receptacle.

C. Device Body: Plastic with nylon face. Color as indicated.

D. Configuration: NEMA 5-20R

E. Ratings

1. 125 volts AC
2. 20 Amperes

2.5 20A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5461 Series
2. Bryant - 5461 Series
3. Hubbell - 5461 Series
4. Approved equal.

B. Description: Heavy duty, 2 pole, 3 wire grounding type simplex receptacle.

C. Device Body: Plastic with brown nylon face.

D. Configuration: NEMA 6-20R

E. Ratings
1. 250 volt AC
2. 20 Amperes

2.6 30A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5700N Series
2. Bryant - 5461 Series
3. Hubbell - 5461 Series
4. Approved equal.

B. Description: Heavy duty, 2 pole, 3 wire grounding type simplex receptacle.

C. Device Body: Plastic with brown nylon face.

D. Configuration: NEMA 6-20R

E. Ratings
1. 250 volt AC

2. 20 Amperes

2.7 50A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 8450 Series
2. Bryant - 8450 Series
3. Hubbell - 8450A Series
4. Approved equal.

B. Description: Heavy duty, 3 pole, 4 wire grounding type simplex receptacle.

C. Device Body: Black Nylon, RTP or urea.

D. Configuration: NEMA 15-50R

E. Ratings
1. 250 volt AC
2. 50 Amperes

2.8 WALL PLATES

A. Interior Cover Plate: 302 Smooth satin finish stainless steel with beveled edges.

1. Manufacturer

a. Bryant
b. Hubbell
c. Arrow-Hart
d. Approved equal.

B. Weatherproof Cover Plate: Gasketed cast aluminum with hinged gasketed self closing device cover designed to fit over a type FS outlet box. All springs, screws and other hardware shall be stainless steel. The plate shall be UL Listed for wet locations with the cover closed.

1. Manufacturer

a. Bryant
b. Hubbell
c. A-H
d. Approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NECA "Standard of Installation", NFPA 70 and manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on bottom.

G. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

H. Install plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping conductor around screw terminal.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

K. Install protective rings on flush cover service fittings.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights indicated on drawings.

3.3 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.4 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.5 CLEANING

A. Clean debris from outlet, and floor boxes and service fittings.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 16170

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.2 RELATED SECTIONS

A. All Division 16 Sections.

1.3 CODES AND STANDARDS

A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedence, and Earth Surface Potentials of a Ground System.

B. NFPA 70 - National Electrical Code.

C. UL 467 - Electrical Grounding and Bonding Equipment

D. UL 486A - Wire Connectors and Soldering Lugs for Use With Copper Conductors.

1.4 GROUNDING ELECTRODE SYSTEM

A. Metal frame of the building.

B. Rod electrode.

1.5 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 10 ohms maximum.

1.6 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different item. The information shall be in the form of manufacturer's standard data sheets.

1. Rod Electrods

    a. Rod material
    b. Dimensions

c. Coupling type

2. Mechanical Connectors

a. Material
b. Connector type

3. Exothemic Connections

a. Process description
b. Mold types
c. Weld material
d. Starting material

4. Grounding Well

a. Dimensioned picture or drawing of grounding well and cover.
b. Well pipe material.
c. Well cover material and legend.

B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.7 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Accurately record actual locations of grounding electrodes, counterpoise, test wells and other inground items. Dimension location from exterior walls and corners of the building.

C. Record location of ground connections for building steel.

1.8 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standard listed in Section 16010.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.11 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

PART 2 PRODUCTS

2.1 ROD ELECTRODE

A. Manufacturers:

1. Apache
2. Galvan
3. ITT Blackburn
4. Approved equal.

B. Material: Copper-clad steel with high-strength steel core and electrolytic grade copper outer sheath, molten welded to the core with tapered point.

C. Diameter: 3/4 inch.

D. Length: 10 feet per section.

E. Couplers: Exothermic welds

2.2 MECHANICAL CONNECTORS

A. Direct buried and Exposed Connectors

1. Manufacturers:

a. Burndy
b. Ilsco
c. ITT Blackburn
d. Thomas & Betts
e. Approved equal.

2. Material: Bronze; mechanical set screw or bolt type or tool applied crimp type. Split bolt connectors are not acceptable.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Burndy
2. Erico Products Inc.
3. Approved equal.

B. Description:

1. Process: Exothermic process that produces molecular bonding of connected items.
2. Approved for exposure or direct burial without degradation.
3. Use graphite molds of proper size and design for the weld and connected items.
4. Weld material: Copper oxide and aluminum mixture with a minimum 3 percent tin.
5. Starting material: Aluminum, copper and iron oxides ignited only by spark ignitor designed for the purpose.
6. Miscellaneous: provide tools and other devices required for a complete weld.
7. All welding materials shall be of the same manufacturer.

2.4 WIRE

A. Material: Copper, 98 percent conductivity; insulated copper for all feeders, branch circuits; bonding jumpers and transformer grounds; solid for 10 AWG and smaller, stranded for larger than 10 AWG. See Section 16123 for insulation types.

B. Foundation Electrodes: Bare, tinned, stranded copper 1/0 AWG.

C. Grounding Electrode Conductor: Insulated copper; Size as indicated.

2.5 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inch diameter by 36 inch long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install Products in accordance with NFPA 70 and manufacturer's instructions.

B. Ground-exposed, noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, and neutral conductor of wiring systems.

C. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground. Locate a minimum of one-rod length from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade. Connect bare-cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated. Proper driving studs and sleeves shall be used when driving ground rods. Water shall be continuously applied, to the ground at the point where the rod penetrates, during the driving process.

D. Provide grounding well pipe with cover at each rod location indicated. Install well pipe top flush with finished grade.

E. Provide bonding jumpers as required by NFPA 70.

F. Bond together metal siding not attached to grounded structure; bond to ground.

G. Use exothermic welded connections for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and other electrodes. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

H. At Test Wells, use compression-type connectors on conductors and make bolted- and clamped-type connections

between conductors and ground rods.

I. Assure the electrical continuity of all metallic raceway systems, pulling up all conduits and/or locknuts wrench tight.

J. Where expansion joints or telescoping joints occur, provide bonding jumpers.

K. Where flexible metallic conduit is employed, provide a green-insulated grounding jumper installed in the flexible conduit.

L. Provide grounding bushings on all service and feeder raceways terminating within switchboards, panelboards, cabinets, and all other enclosures. Provide grounding conductors from such bushings to the frame of the enclosure and to the ground bus or equipment grounding strap.

M. Provide separated isolated grounding conductor within each feeder or branch circuit raceway for circuits where indicated. Refer to Section 16123 for identification.

N. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Refer to Section 16123 for identification.

3.3 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.4 TESTING

A. The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 10 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than one rod length on center, shall be added (up to a minimum of 3 rods per location) or if sectional type rods are used, additional sections may be coupled and driven with the first rod. If the resultant resistance exceeds 10 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations.

END OF SECTION

SECTION 16180

EQUIPMENT WIRING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to Government-furnished equipment and equipment specified under other sections.

1.2 RELATED SECTIONS

A. Division 0 - Contract Requirements.

B. Division 1 - General Requirements

C. Division 11 - Equipment

D. Division 12 - Furnishings

E. Division 15 - Mechanical

F. 16010 - General Provisions, Electrical

H. 16111 - Conduit

J. 16123 - Building Wire and Cable

K. 16130 - Boxes

L. 16140 - Wiring Devices

M. 16170 - Grounding and Bonding

N. 16190 - Supporting Devices

O. 16195 - Electrical Identification

P. 16441 - Enclosed Switches

Q. 16470 - Panelboards

R. 16476 - Enclosed Circuit Breakers

S. 16477 - Fuses

T. 16481 - Enclosed Motor Controllers

1.3 CODES AND STANDARDS

A. Refer to Section 16010.

B. Specific codes and standards listed in applicable Division 16 sections for equipment, devices, wiring, etc. used for connection to equipment.

1.4 REGULATORY REQUIREMENTS

A. Refer to Section 16010.

1.5 EQUIPMENT CONNECTIONS

A. Contractor shall make connections to Government-furnished equipment and equipment furnished by other sections requiring electrical connections. Provide miscellaneous items such as disconnect switches, starters, plugs, receptacles, boxes, conduit, wire cords, etc. as indicated and required to make the connection.

1.6 CONTROL WIRING

A. Control equipment furnished under this section of the specifications, and shown on the drawings, shall be connected under this section of the specifications unless shown or specified otherwise. Except as otherwise specifically noted, automatic-control wiring, signaling, and protective devices are not included in this section of the specifications, but shall be furnished and installed under other sections of the specifications. Control wiring not shown on the drawings shall be furnished under the other sections of the specifications.

1.7 COORDINATION

A. Refer to applicable sections of Division 1.

B. Obtain and review shop drawings, rough-in drawings, product data, and manufacturer's instructions for equipment furnished under other sections to determine connection locations and requirements.

C. Capacities of feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices indicated to be furnished and installed by the Electrical Contractor for electrically operated equipment, regardless of who furnishes and/or installs that equipment, are based upon the average horsepower and/or electrical ratings of the types andsizes of the equipment used. Before commencing electrical work for electrically operated equipment, the electrical section shall: check horsepower and/or electrical rating of each individual electrically operated equipment items, regardless of who furnished and/or installs that equipment.

D. Switches, circuit breakers, motor starters, protective devices, and other electrical devices furnished by other Sections and by others for installation and/or wiring by Electrical Contractor, are specified elsewhere to have adequate capacities to serve the electrically operated equipment which they are furnished. However, BEFORE installing and/or wiring each of these devices, the Electrical Contractor shall check each individual device's electrical rating with the horsepower and/or electrical rating of the corresponding electrically operated equipment actually installed, regardless of who furnishes and/or installs the devices and equipment. The Electrical Contractor shall not install and/or wire any device that is found to be the incorrect size. The Contractor shall notify the Resident Officer In Charge of any such discrepancies.

E. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

F. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 PRODUCTS

2.1 GENERAL

A. Equipment, devices, wiring, etc. as required shall be as specified in the appropriate Division 16 section.

2.2 RECEPTACLES

A. Configuration: match configuration for plug provided with equipment where applicable.

PART 3 EXECUTION

3.1 ELECTRICAL CONNECTIONS

A. All electrical outlets, switches, starters, etc. shall be installed in approximately the locations indicated. Adjustments shall be made as required, to avoid interferences with installed equipment, work by other divisions, and structure. Code required clearances shall be maintained around electrical equipment. Electrical equipment shall not be installed as to interfere with the working and maintenance spaces of equipment provided by other sections.

B. Electrical equipment, fixtures, outlets and connections to equipment furnished by others may be moved up to ten feet from the location shown on the drawings without any cost

to the owner if the contractor is notified before the electrical work for that item is installed.

C. Electrical equipment, devices, wiring, etc. shall be installed in accordance with the appropriate Division 16 section.

D. Extend wiring to the equipment and make proper connections thereto.

E. Make electrical connections in accordance with equipment manufacturer's instructions.

F. Where indicated, make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations. Flexible conduits with a minimum length of 18 inches or 12 times the diameter of the conduit whichever is greater, shall be provided to all equipment subject to periodic removal, vibration, or movement and for all motors.

G. Make connections to motors, not near walls or columns, with a vertical rigid metal conduit, minimum size 3/4", attached to the floor and ceiling. Wiring shall be carried into and out of this conduit by means of condulets and flexible conduit.

H. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

I. Provide receptacle outlet where connection with attachment plug is indicated. Install the receptacle as close as practicable to the equipment served. Provide cord and cap where field-supplied attachment plug is indicated.

J. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

K. Provide interconnecting conduit and wiring between devices and equipment where indicated.

L. Motors: All motors shall be provided with separate grounding conductors.

END OF SECTION

SECTION 16190

SUPPORTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel channel for conduit and equipment supports.

B. Anchors and fasteners.

C. Spring steel clips

D. Hangers, Clamps and fittings.

E. "J" hook hangers

F. Cable ties

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. All Division 16 Sections.

1.3 CODES AND STANDARDS

A. NECA - Standard of Installation

B. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Product Data: Provide manufacturer's standard catalog data for fastening and support devices and channel.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, and preparation, installation, of the Product.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standard listed in Section 16010.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:

1. Concrete Structural Elements: Use precast insert system, expansion anchors, powder actuated anchors and preset inserts as applicable.
2. Steel Structural Elements: Use beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners as applicable.
3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors and preset inserts.
6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

2.2 STEEL CHANNEL

A. Manufacturer:
1. Allied
2. B-Line
3. Kindorf
4. Superstrut
5. Unistrut

6. Approved equal.

B. Description: 14 gauge minimum Galvanized or Painted steel with factory punched attachment holes. Nuts, bolts, straps and other accessories shall be designed for use with the channel.

2.3 SPRING STEEL CLIPS

A. Manufacturer:
1. B-Line
2. Erico
3. Approved equal.

2.4 HANGERS, CLAMPS AND FITTINGS

A. Manufacturer:
1. Allied
2. B-Line
3. Kindorf
4. Superstrut
5. Unistrut
6. Approved equal.

B. Description: Galvanized steel.

2.5 CABLE TIES

A. Manufacturer:

1. 3M
2. Ideal
3. Panduit
4. Thomas & Betts
5. Approved equal.

B. Description: One piece, nylon.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with NFPA 70 and the manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use tie wire, perforated pipe straps or nylon ties to support conduits.

E. C-clamps or beam clamps shall have strap or rod-type retainers.

F. Raceways or pipe straps shall not be welded to steel structures.

G. In partitions of light steel construction, sheet-metal screws may be used.

H. Load applied to fasteners shall not exceed one-fourth test load.

I. Fasteners attached to concrete ceiling shall be vibration-resistant and shock-resistant.

J. Where raceway, boxes and equipment is supported on gypboard and studwalls, vertical and horizontal bracing in the wall shall be provided to support the weight of the raceway, etc. and to receive the screws.

K. Obtain permission from Architect/Engineer before drilling or cutting structural members.

L. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

M. Install surface-mounted cabinets and panelboards with minimum of four anchors.

N. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.

END OF SECTION

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Identification Plates.

B. Wire and cable markers.

C. Underground Utility Warning tape.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical

B. Section 16123 - Building Wire and Cable.

C. Section 16441 - Enclosed Switches

D. Section 16461 - Dry Type Transformers

E. Section 16470 - Panelboards

F. Section 16476 - Enclosed Circuit Breakers

G. Section 16481 - Enclosed Motor Controllers

H. Section 16485 - Contactors

I. Section 16721 - Fire Alarm System

J. Section 16741 - Interior Telephone and Data, Pathways, and Wiring

1.3 CODES AND STANDARDS

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Product Data: Provide manufacturer's standard catalog data for nameplates, and markers.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation and

installation of Product.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

A. Engraved, Plastic-Laminated Identification Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners. Edges shall be chamfered. Plates shall be fastened with black-finished round-head screws or rivets, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location.

B. Locations:

1. Refer to each related section for detailed information about plate locations and wording.

C. Letter Size:

1. Use 1/4 inch letters for identifying individual equipment and loads.
2. Use 1/2 inch letters for identifying grouped equipment and loads.
3. Use 1/2 inch letters for identifying Panelboards and cabinets.

2.2 WIRE AND CABLE MARKERS

A. Wire and cable designation tape markers.

1. Manufacturers:

a. Seton
b. Almetek

c. Thomas and Betts
d. Panduit
e. Approved equal.

2. Description: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

B. Colored Adhesive Marking Tape

1. Manufacturers
a. 3M
b. Plymouth
c. Thomas and Betts
d. Approved equal.

2. Description: Self-adhesive vinyl tape not less than 7 mils thick by 3/4 inch to 2 inches in width.

C. Locations: Refer to each related section for detailed information about locations and indications.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive plates and markers.

3.2 APPLICATION

A. Install identification plates parallel to equipment lines.

B. Install all products in accordance with manufacturer's instructions.

C. Refer to Section 16111 for installation requirements for underground utility warning tape.

END OF SECTION

SECTION 16441

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fusible Disconnect switches.

B. Nonfusible Disconnect switches.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical

B. Section 16170 - Grounding and Bonding

C. Section 16180 - Equipment Wiring Systems

D. Section 16190 - Supporting Devices

E. Section 16191 - Seismic Restraint Systems

F. Section 16195 - Electrical Identification

G. Section 16477 - Fuses

1.3 CODES AND STANDARDS

A. NEMA ICS6 - Enclosure for Industrial Controls Systems

B. NEMA KS 1 - Enclosed Switches.

C. NFPA 70 - National Electrical Code.

D. NECA - Standard for Installation.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different disconnect switch. The information shall be in the form of the manufacturer's standard data sheets.

1. Voltage rating
2. Ampere rating
3. Horsepower rating
4. Number of poles
5. Switch and contact materials
6. Fuseclips

7. Fuse type and ratings
8. Handle; interlock and padlocking provisions.
9. Enclosure type
10. Enclosure material and finish.
11. Dimensioned picture or drawing of the switch.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the switch.

1.5 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual location, size of the disconnect switch and the circuit to which it is connected.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 FIELD MEASUREMENTS

A. The locations of disconnect switches indicated on the drawings are approximate. Coordinate the exact location with equipment, etc. so that access and proper clearances are maintained.

1.11 EXTRA MATERIALS

A. Provide three of each size and type of fuses installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General Electric

B. Siemens ITE

C. Square D

D. Westinghouse

E. Approved equal.

2.2 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with high conductivity copper current carring parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position with two padlock provisions. Fuse clips: Positive pressure reinforced designed to accommodate Class R fuses.

B. Nonfusible Switch Assemblies: 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with high conductivity copper current carring parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position with two padlock provisions.

C. Ratings: The number of poles, switch ampere rating and fuse ampere rating shall be as indicated.

D. Fuses: UL Class RK1 unless otherwise indicated. Refer to Section 16477 - Fuses.

E. Enclosures: Surface mounted, code gauge steel with manufacturer's standard gray enamel finish.

1. Interior Dry Locations: NEMA Type 1.
2. Exterior Locations: NEMA Type 3R.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install disconnect switches level and plumb.

B. Install fuses in fusible disconnect switches.

C. Provide proper anchors and supports. Refer to Section 16190 and 16191.

D. Identify each disconnect switch, by attaching to the device cover a laminated plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with 1/4" minimum high white characters.

END OF SECTION

SECTION 16461

DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dry type two winding transformers.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 16010 - General Provisions - Electrical.

C. Section 16170 - Grounding and Bonding.

D. Section 16190 - Supporting Devices.

E. Section 16191 - Seismic Restraint Systems.

1.3 REFERENCES

A. NEMA ST 20 - Dry Type Transformers for General Applications.

B. NFPA 70 - National Electrical Code.

C. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each transformer. The information shall be in the form of the manufacturer's standard data sheets or drawings.

1. KVA rating
2. Voltage ratings
3. Winding configuration and taps
4. Temperature rise rating
5. Insulation type and rating
6. Impedance
7. Noise level
8. Weight
9. Cabinet material
10. Finish
11. Dimensioned picture or drawing

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation, of the transformer.

C. Tap Adjustments: Provide a report describing transformer, initial voltages of both primary and secondary windings, final voltages of primary and secondary as well as tap positions used to obtain those final voltages.

1.5 PROJECT DOCUMENTS

A. Refer to Section 16010.

B. Record the actual location and size to scale of transformers on the drawings.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance data: Submittal data sheets.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store, protect, and handle products to site.

B. Deliver transformers individually wrapped for protection and mounted on shipping skids.

C. Accept transformers on site. Inspect for damage.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Manufacturers:

1. General Electric
2. Siemens ITE
3. Square D
4. Cutler-Hammer/Westinghouse
5. Approved equal.

B. Description: factory-assembled, air cooled dry type transformers, two-winding type, 600 volt or less, single or 3-phase, as indicated with one coil per phase in primary and secondary; ratings as indicated. 3-phase transformers shall be connected delta on the primary and wye connected on the secondary.

C. Cores: Grain-oriented, nonaging silicon steel.

D. Insulation system and average winding temperature rise for rated KVA as follows:

1. 15 KVA or Less: Class 185 or 220 with 115 degrees C rise.
2. Larger than 15 KVA: Class 220 with 115 degrees C rise.

E. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point.

F. Winding Taps:

1. Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
2. Transformers 15 KVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below rated voltage.

G. Sound Levels:

10-50 KVA: 45 dB
51-150 KVA: 50 dB

H. Basic Impulse Level: 10 KV for transformers less than 300 KVA, 30 KV for transformers 300 KVA and larger.

I. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

J. Mounting: 15 KVA and smaller - floor or wall mounted; above 15 KVA - floor mounted.

K. Coil Conductors: Copper continuous windings without splices except for taps with terminations brazed, welded or pressure type.

L. Where transformers are indicated as shielded isolation type, they shall have an electrostatic shield and a K-factor as indicated.

M. Enclosure: Code gauge steel; NEMA Type 1, ventilated or totally enclosed nonventilated as indicated. Provide lifting eyes or brackets. Finish shall be manufacturer's standard gray enamel.

N. Isolate core and coil from enclosure using neoprene vibration-absorbing mounts.

O. Fungus Proofing: Permanent fungicidal treatment for coil and core.

2.2 SOURCE QUALITY CONTROL

A. Provide production testing of each unit in accordance with NEMA ST20.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are suitable for installing transformer supports.

3.2 PREPARATION

A. Provide concrete pad under provisions of Section 16010.

3.3 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Set transformer plumb and level.

C. Use flexible conduit, under the provisions of Section 16111, 2 ft minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

D. Mount transformers on neoprene vibration isolating pads suitable for isolating the transformer noise from the building structure.

E. Provide seismic restraints as per Section 16191.

F. Provide grounding and bonding in accordance with Section 16170 and as indicated.

G. Identification: Identify each transformer with a laminated plastic nameplate engraved with 1/2 inch minimum height characters showing the designation indicated on the drawings, the circuit number and device size from which it is fed and the primary feeder size. The nameplate shall be black with white characters and secured to the front of the transformer.

3.4 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Service and distribution panelboards.

B. Lighting and Appliance Branch circuit panelboards (hereafter referred to as branch circuit panelboards).

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 16010 - General Provisions - Electrical.

C. Section 16190 - Supporting Devices.

D. Section 16195 - Electrical Identification.

E. Section 16477 - Fuses.

1.3 CODES AND STANDARDS

A. NECA (National Electrical Contractors Association) "Standard of Installation".

B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

C. NEMA FU 1 - Low Voltage Cartridge Fuses

D. NEMA KS 1 - Enclosed Switches.

E. NEMA PB 1 - Panelboards.

F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

G. NEMA PB2.2 - Application Guide for Ground Fault Protective Devices for Equipment.

H. NFPA 70 - National Electrical Code.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

J. UL 50 - Cabinets and Boxes

K. UL 67 - Panelboards

L. UL 98 - Enclosed and Dead-Front Switches

M. UL 198C - High-Interrupting-Capacity Fuses, Current-Limiting Types

N. UL 198D - High-Interrupting-Capacity Fuses, Class K fuses.

O. UL 198E - Class R Fuses

P. UL 198G - Fuses for Supplementary Overcurrent Protection

Q. UL 486A-80-Wire Connectors And Soldering Lugs For Use With Copper Conductors.

R. UL 489 - Molded-Case Circuit Breakers and Circuit - Breaker Enclosures.

S. UL 512 - Fuseholders

T. UL 869A - Service Equipment

U. UL 1053-88 - Ground-Fault Sensing and Relaying Equipment.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each panelboard. The information may be in the form of schedules, and/or manufactures standard drawings. The manufacturers standard drawings shall indicate, by panel designation, the panelboard for which they apply.

1. Panelboard designation from the construction drawings.
2. Manufacturer's series or catalog number.
3. Enclosure NEMA rating (1, 3R, etc.)
4. Metal gage for backbox, dead-front and trim.
5. Enclosure mounting type (flush, surface, etc.)
6. Backbox and panel interior mounting provisions.
7. Front and/or rear accessibility.
8. Enclosure dimensions (height, width, depth)
9. Trim type (flush, with door; surface, without door; etc.) and the method for securing trim to the panel.
10. Type of door latch, lock and hinges.
11. Finish of the panel, deadfront and trim.
12. Top or bottom feed.
13. Gutter sizes.
14. Removable end panels (blank or with knockouts)

15. Voltage rating
16. Number of phases and phasing diagram.
17. Neutral bus (if required)
18. Equipment ground bus
19. Isolated ground bus (if required)
20. Frequency
21. Material and ampere rating of main lugs, and phase, neutral and ground busses.
22. Bus insulation and isolation material.
23. Designation, quantity, voltage, load and fault current ampere ratings for overcurrent devices including spares.
24. Termination temperature ratings of lugs and overcurrent devices.
25. Settings for adjustable circuit breakers.
26. Fuse sizes and designations (U.L. class)
27. Number of provisions including circuit breaker frame sizes, fused switch sizes and poles.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and start-up of the panelboards.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual locations of panelboards; indicate actual branch circuit arrangement on panelboard schedule.

B. Refer to Section 16010.

1.6 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include spare parts data listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.

B. Refer to Section 16010.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standard listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL label.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

1.11 MAINTENANCE MATERIALS

A. Provide maintenance materials.

B. Provide 2 panelboard keys.

C. Provide two fuse pullers.

D. Obtain a signed receipt from the user's representative for all materials provided.

1.12 EXTRA MATERIALS

A. Provide three of each different size and type of fuse.

B. Provide three of each different size and type of single pole circuit breaker and one of each different size and type of two and three pole circuit breakers.

C. Obtain a signed receipt from the user's representative for all materials provided.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. G.E.

B. Square D

C. Cutler-Hammer/Westinghouse

D. Siemens

E. Approved equal.

2.2 MAIN DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, dead-front circuit breaker type,

or fused switch type as indicated for 600 volts or less, 100 - 1200 amps and group mounted devices. Load centers are not acceptable.

B. Service Conditions:

1. Temperature: 89 degrees F.
2. Altitude: 268 feet above sea level.

C. Panelboard Buses: Provide tin plated copper phase buses, connector fingers and neutral buses of 98 percent conductivity, and ratings as indicated. Provide a separate copper equipment ground bus, bonded to the cabinet, in each panelboard. Provide a separate copper isolated ground bus, insulated from the cabinet where indicated. Phase buses shall be one continuous bar per phase, factory assembled and provide sequentially phased branch distribution. Phase buses shall be separated and rigidly supported by insulating material rated for the applicable voltage, amperage and fault currents. The neutral bus shall have the same ampere rating as the phase buses or 200 percent of the phase buses where indicated. Provide a neutral bonding strap for panels rated for service equipment. Neutral and ground buses shall have a separate lug for each wire connection. All buses shall be labeled or identified as to their purpose.

D. Cable Connections: Cable connection lugs shall be copper alloy, compression solderless lugs rated for the type and temperature rating of the wire used.

E. Main Devices: These shall be main lugs, fused switch or circuit breaker as indicated.

F. Minimum integrated short circuit rating: As indicated.

G. Device Mounting: Circuit breakers and fused switches shall be capable of being removed or installed without disturbing adjacent devices.

H. Provisions for Future Devices: Provisions for future fused switches and circuit breakers shall be equipped with hardware and busses to accept the size switch or breaker indicated.

I. Enclosure: NEMA PB 1, Type 1,3R or 12; flush or surface mounted as indicated.

J. NEMA 1 Enclosure: Backbox shall be galvanized, code thickness, steel with removable end walls, adjustable panel interior mounting studs or brackets and provisions for mounting the panel deadfront and trim. End walls may

or may not have knockouts for conduits. Backboxes shall be sized to provide wiring gutter space per the N.E.C. and U.L. standards. The backbox shall have a separate UL label from the panelboard. The backbox shall be provided by the same manufacturer as the panelboard.

Branch circuit and distribution panelboards shall have dead-front trims of code thickness, secured to the panel interior with screws. The dead-front for circuit breaker panels shall have twist out, or snap-in fillers or plates secured with screws for device provisions. The dead-front for fused switch panels shall have metal plates secured with screws for provisions. All flush mounted branch circuit and distribution panelboards shall have one piece flush trims which overlap the backbox a minimum 3/4" on all sides with hinged doors and trim clamps for adjusting. Surface mounted branch circuit panelboards shall have one piece surface trims, which is the same size as the backbox with hinged doors and trim clamps for adjusting. Surface mounted distribution panels shall have one or four piece surface trims which is the same size as the backbox without hinged doors and secured with screws.

Doors in flush or surface mounted branch circuit panel trims and flush mounted distribution panel trims shall have concealed hinges, and flush mounted latch and cylinder lock. Doors in surface mounted distribution panel trims shall have flush mounted latch or handle and flush mounted cylinder lock and may have exposed hinges. Doors over 48 inches high shall have three point latching. All locks shall be keyed alike. Doors shall have a metal directory card frame with a circuit directory card and clear plastic cover mounted on the inside face.

Dead-fronts and flush and surface trims shall be phosphatized steel and finished in the manufacturer's standard baked or electrodeposited gray enamel or lacquer finish unless otherwise indicated.

K. All panelboards shall be of the same manufacturer.

2.3 CIRCUIT BREAKERS

A. Circuit breakers shall be as specified and of the types as listed below.

B. Circuit breakers shall have voltage, current, pole and interrupting ratings as indicated.

C. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type, automatic, integral thermal and instantaneous magnetic trip in each pole, with common trip handle for all poles.

Single pole breakers with field installed handle ties are not acceptable. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupted circuit breakers where schedule. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits. Do not use tandem circuit breakers.

2.4 Fusible Switch Assemblies: Fused switches shall be NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with hinged front cover and externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle shall be lockable in OFF position. Fuse clips shall be designed to accommodate fuses as indicated. Switches serving as motor disconnect means shall be horsepower rated in conformance with UL-98.

2.5 FUSES

A. Fuses shall be as specified in Section 16477, "Fuses" and of the types as listed below.

B. Fuses 600 Amperes and Less: Dual element, current limiting, time delay, one time fuse, 250 and 600 volt, as applicable UL Class RK1 unless otherwise indicated.

C. Interrupting Rating: 200,000 rms amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with manufacturer's requirements.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 16190.

C. Panelboards shall not be supported by branch circuit or feeder conduits.

D. Provide one required size bolt in each mounting hole in the backbox.

E. Mounting Height: 6'-6" above the finished floor to top of panelboard; install panelboards taller than 6'-6" such that the operating handle of the top devices is no more than 6'-6" above the finished floor.

F. Provide filler plugs for unused conduit openings in panelboards.

G. Provide spare conduits out of each recessed branch circuit and distribution panelboard up to the nearest accessible ceiling space. Provide one 1/2 inch conduit for every three spare single pole breakers or provisions. Provide one conduit for each two and three pole spare breaker or switch or provision. The conduit size shall be based on a four wire circuit for two pole breakers and switches and on a five wire circuit for three pole breakers and switches and on the corresponding phase, neutral and equipment grounding conductor for the spare or provision breaker frame or switch size. Spare conduits shall be capped. Spare conduits may not be provided for surface mounted panelboards unless otherwise indicated.

H. Train conductors, in panel gutters, neatly in groups, bundle, and wrap with wire ties.

I. Do not install panelboards under piping or ductwork.

J. Identification

1. Identification of Circuits and Equipment: Identification designations shall correspond to those indicated on the electrical drawings.
2. Each overcurrent device in panelboards with doors shall be permanently identified by circuit number on the dead-front with additional information on the directory card.

   Each overcurrent device in panelboards without doors shall be permanently identified by a laminated plastic nameplate engraved with 1/8 inch (3 mm) minimum height characters showing the circuit number, the load served by the device and the location of the load. The nameplate shall be white with black characters and securely attached to the dead-front or the hinged door for fused switches.
3. Clearly typewrite on each panelboard directory card the designations of the fixtures, outlets and equipment served by each device in the panelboard reflecting as-built circuiting. Panelboard directory cards shall indicate actual assigned room numbers and not those indicated on the plans if different.
4. Identify each entire panelboard assembly with a laminated plastic nameplate engraved with 1/2 inch minimum height characters showing panelboard designation. The nameplate shall be white with black characters and securely attached to the outside front of the panel. Provide an additional separate

laminated plastic sign of the same specifications which indicates the feeder size, circuit number, protective device size and origin from which it is fed and securely attach to the inside of panelboard door over directory card for panels with doors and on the outside of the trim for panels without doors.

5. Each panelboard shall have a metal nameplate with the panel voltage, phases, wire, ampere and frequency ratings stamped or engraved on the plate. The manufacturer's name, model number, etc. and the UL label shall also be permanently printed on the plate. The plate shall be attached to the deadfront of the panelboard.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for lugs, circuit breakers, fusible switches and fuses. Exercise all devices for proper operation. Touch-up all scratches in the finish with manufacturer's approved touch-up paint. Check all labeling for compliance with the specifications. Check for piping or ductwork that may have been installed over the panelboard after installation.

END OF SECTION

SECTION 16476

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical

B. Section 16170 - Grounding and Bonding

C. Section 16180 - Equipment Wiring Systems

D. Section 16190 - Supporting Devices

E. Section 16191 - Seismic Restraint Systems

F. Section 16195 - Electrical Identification

G. Section 16477 - Fuses

1.3 CODES AND STANDARDS

A. NECA (National Electrical Contractors Association) "Standard of Installation."

B. NEMA AB 1 - Molded Case Circuit Breakers

C. NFPA 70 - National Electrical Code.

D. UL 489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each enclosed circuit breaker. The information shall be in the form of manufacturer's standard data sheets.

1. Manufacturer's series or catalog number.
2. Enclosure NEMA rating (1, 3R, etc.)
3. Metal gage for enclosure.
4. Enclosure mounting type (flush, surface, etc.)
5. Enclosure dimensions (height, width, depth)
6. Finish of the enclosure.

7. Neutral bus (if required).
8. Equipment ground bus.
9. Isolated ground bus (if required).
10. Designation, voltage, load and fault current ampere ratings for circuit breakers.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the enclosed circuit breaker.

1.5 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual locations of enclosed circuit breakers; indicate actual branch circuit.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 FIELD MEASUREMENTS

A. Locations of enclosed circuit breakers indicated on the drawings are approximate. Coordinate the exact location with equipment, etc. so that access and proper clearances are maintained.

1.11 EXTRA MATERIALS

A. Provide three of each size and type current limiter.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General Electric

B. Siemens ITE

C. Square D

D. Cutler-Hammer/Westinghouse

E. Approved equal.

2.2 MOLDED CASE CIRCUIT BREAKER

A. Circuit Breaker: NEMA AB 1.

B. Service Conditions:

1. Temperature: 89 degrees F.
2. Altitude: 268 feet.

2.3 PRODUCT OPTIONS AND FEATURES

A. Provide accessories as indicated.

B. Shunt Trip Device: 120 volts, AC, coordinate with fire alarm system.

C. Auxiliary Switch: 120 volts, AC.

D. Electrical Operator: 120 volts, AC.

E. Handle Lock: Include provisions for padlocking.

F. Provide mechanical trip device.

G. Provide insulated grounding lug in each enclosure.

H. Provide Products suitable for use as service entrance equipment where so indicated.

2.4 ENCLOSURE

A. Enclosure: NEMA Type as indicated.

B. Fabricate enclosure from code gauge steel.

C. Finish shall be manufacturer's standard gray enamel finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 16190 and 16191.

C. Height: 5 ft to operating handle.

D. Provide engraved plastic nameplates under the provisions of Section 16195. Identify each separately enclosed circuit breaker, by attaching to the device cover a laminated plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with 1/2" high white characters.

3.2 FIELD QUALITY CONTROL

A. Inspect each circuit breaker visually.

B. Perform several mechanical ON-OFF operations on each circuit breaker.

END OF SECTION

SECTION 16477

FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical

B. Section 16180 - Equipment Wiring Systems

C. Section 16441 - Enclosed Switches

D. Section 16470 - Panelboards

E. Section 16481 - Enclosed Motor Controllers

1.3 CODES AND STANDARDS

A. NFPA 70 - National Electric Code.

B. NEMA FU 1 - Low Voltage Cartridge Fuses.

C. UL 198C - High-Interrupting Capacity Fuser; Current Limiting Type.

D. UL 198E - Class R Fuses

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Data: Provide data sheets showing electrical characteristics including time-current curves for each different type and size fuse.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual fuse sizes.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 MAINTENANCE MATERIALS

A. Provide two fuse pullers.

1.11 EXTRA MATERIALS

A. Provide three of each size and type fuse installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussman

B. Brush Fuse

C. Gould Shawmut

D. Approved equal.

2.2 FUSE REQUIREMENTS

A. Description: Nonrenewable, dual element, cartridge type; UL, Class as specified or indicated.

B. Amperage: As indicated.

C. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage indicated.

D. Fuses up to 600 amperes: UL Class RK1 time delay, current limiting type, 200,000 A.I.C. unless otherwise indicated.

E. Fuses over 600 amperes: UL Class [L], time delay, current limiting type, 200,000 A.I.C. unless otherwise indicated.

F. All fuses shall be of the same manufacturer.

2.3 SPARE FUSE CABINET

A. Description: Wall-mounted code gauge steel cabinet, suitably sized to store spare fuses and fuse pullers specified.

B. Doors: Hinged, with hasp for User's padlock.

C. Finish: Manufacturer's standard gray enamel finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

END OF SECTION

SECTION 16481

ENCLOSED MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manual motor starters.

B. Magnetic motor starters.

C. Combination magnetic motor starters.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical

B. Section 16170 - Grounding and Bonding

C. Section 16180 - Equipment Wiring Systems

D. Section 16190 - Supporting Devices

E. Section 16195 - Electrical Identification

F. Section 16191 - Seismic Restraint Systems

G. Section 16477 - Fuses

1.3 CODES AND STANDARDS

A. NFPA 70 - National Electrical Code.

B. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.

C. UL 508 - Industrial Control Equipment

D. UL 198E - Class R Fuses.

E. UL 468A - Wire Connectors and Soldering Lugs for Use With Copper Conductors.

F. NECA "Standard of Installation," published by National Electrical Contractors Association.

G. NEMA AB 1 - Molded Case Circuit Breakers.

H. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

I. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

J. NEMA KS 1 - Enclosed Switches.

K. NEMA 250 - Enclosures for Electrical Equipment (1000 volts maximum)

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different motor controller. The information shall be in the form of the manufacturer's standard data sheets.
1. Manufacturer's series or catalog number.
2. Enclosure NEMA type, material, interlocks, finish, etc.
3. Motor starter type
4. Starter NEMA size
5. Voltage rating
6. Contact material
7. Coil voltage
8. Overload relay type and number
9. Number, type and ratings of auxiliary contacts
10. Types and ratings of pushbuttons, indicating lights and selector switches
11. Types and ratings of auxiliary relays
12. Disconnect type
13. Frame or switch size
14. Voltage and amperage ratings
15. Fault current interrupting rating
16. Fuse class, type and ratings

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of the motor controller.

C. Motor Tests: Provide report on phasing and rotation and actual voltage and amperage for each motor.

1.5 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual locations of motor controllers; indicate actual branch circuit.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 FIELD MEASUREMENTS

A. The locations of enclosed motor controllers indicated on the drawings are approximate. Coordinate the exact location with equipment, etc., so that access and proper clearances are maintained.

1.11 EXTRA MATERIALS

A. Provide three of each size and type fuse installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General Electric

B. Siemens ITE

C. Square D

D. Cutler-Hammer/Westinghouse

E. Approved equal.

2.2 MANUAL CONTROLLERS

A. Manual Motor Controller: Single, double or three pole as

indicated, AC general-purpose Class A manually operated, full-voltage controller with manual reset overload element, in each phase, red pilot light, auxiliary contact as indicated, and push button or toggle operator.

B. Fractional Horsepower Manual Controller: single or double pole as indicated, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with manual reset thermal overload unit in each phase, red pilot light, and toggle operator.

C. Motor Starting Switch: Single pole, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light and toggle operator.

D. Enclosure: NEMA; Type as indicated; flush or surface mounted as indicated.

2.3 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers: Across-the-line type, full voltage, non-reversing unless otherwise indicated, AC general-purpose Class A magnetic controller for induction motors rated in horsepower. Contacts shall be copper with weld resistant silver cadmium oxide.

B. Star-Delta Reduced Voltage Type: Closed transition with adjustable time delay.

2.4 PRODUCT OPTIONS AND FEATURES

A. Coil operating voltage: Phase voltage if all controls are within the controller enclosure; 120 volts if control circuits extend outside of the controller enclosure.

B. Overload Relay: Class 10; bimetal; manual reset; one overload in each phase; integral with controller.

C. Auxiliary Contacts: 2 each normally open and closed contacts in addition to seal-in contact.

D. Cover Mounted Pilot Devices: heavy duty oiltight type.

E. Pilot Device Contacts: Form Z, rated A150.

F. Pushbuttons: Shrouded momentary contact type.

G. Indicating Lights: neon type.

H. Selector Switches: Rotary type, 3 position, manual-off-

automatic.

I. Relays: Solid state phase loss relay to monitor voltage of all 3 phases.

J. Control Power Transformers: 120 volt secondary, 50 va minimum, in each motor starter. Provide fused secondary, and bond unfused leg of secondary to enclosure.

K. Control Voltage: Line voltage where all controls are within the controller enclosure; 120 volts ac where control devices are located outside of the controller enclosure.

L. Enclosure: Code gauge steel; NEMA Type As indicated with locking provisions and manufacturer's standard gray enamel finish.

2.5 DISCONNECTS

A. Combination Controllers: Combine motor controllers with non-fusible switch or fusible switch disconnect as indicated in common enclosure. The cover of the enclosure shall be interlocked with the operating handle of the switch so that the cover cannot be opened unless the switch handle is in the off position.

B. Nonfusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle and locking provisions.

B. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle and locking provisions. Fuse clips: Designed to accommodate Class R fuses.

2.6 FUSES

A. Refer to Section 16477.

B. Description: Dual element, current limiting, time delay, one-time fuse, 250 or 600 volt as indicated, UL Class RK 1 unless otherwise indicated.

C. Interrupting Rating: 200,000 rms amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed controllers where indicated, in

accordance with manufacturer's instructions.

B. Install enclosed controllers plumb. Provide supports in accordance with Section 16190 and 16191.

C. Height: 5 ft to operating handle.

D. Install fuses in fusible switches.

E. Select and install overload heater elements in motor controllers to match installed motor characteristics.

F. Install wiring in enclosures neatly trained.

G. Provide engraved plastic nameplates under the provisions of Section 16195. Identify each magnetic motor starter, and manual motor starter, by attaching to the device cover a laminated plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with 1/4" high white characters.

3.2 FIELD QUALITY CONTROL

A. Verify correct phasing and rotation of motors.

B. Measure the voltage and amperage for each phase and verify that measurements are within motor nameplate ratings.

END OF SECTION

SECTION 16485

CONTACTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power contactors.

B. Lighting contactors.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical

B. Section 16170 - Grounding and Bonding

C. Section 16180 - Equipment Wiring Systems

D. Section 16190 - Supporting Devices

E. Section 16191 - Seismic Restraint Systems

F. Section 16195 - Electrical Identification

1.3 CODES AND STANDARDS

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different contactor. The information shall be in the form of manufacturer's standard data sheets or drawings. The data sheets or drawings shall indicate, by contactor designation, the contactor for which they apply.

1. Manufacturer's series or catalog number
2. Enclosure NEMA rating and dimensions
3. Enclosure material and finish
4. Contactor type
5. Number of poles
6. Voltage and amperage ratings of contacts

7. Contact material
8. Coil voltage
9. Control relay
10. Type and ratings of selector switch
11. Wiring diagram

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of the contactor.

1.5 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual locations of each contactor and indicate circuits controlled.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets; include instructions for replacing and maintaining coil and contacts.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standard listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 FIELD MEASUREMENTS

A. The locations of contactors indicated on the drawings are approximate. Coordinate the exact location with equipment, etc. so that access and proper clearances are maintained.

PART 2 PRODUCTS

2.1 LIGHTING CONTACTORS

A. Mechanically or Magnetically Held Lighting Contactors:

1. Manufacturers:

(1) Asco 917
(2) G.E. CR160MA
(3) Square D Class 8903 type LX
(4) Cutler-Hammer/Westinghouse Class A202
(5) Approved equal.

2. Description:

a. Number of poles as indicated
b. Load contacts rated 20 amperes continuous, at 480/277 volts for tungsten, fluorescent or H.I.D. lighting loads.
c. Coil voltage 120 VAC
d. Control relay or module for two wire control.
e. Coil clearing contacts so that contactor coils shall be energized only during the instance of operation.
f. NEMA Type 1 enclosure; code gauge steel with manufacturer's standard gray enamel finish.
g. Hand/off/Auto Selector Switch

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide a laminated plastic nameplate attached with screws or rivets to the outside of the enclosure. The nameplate shall be black with 1/4" high white characters which indicates the contactor designation, the item and the circuits it controls.

END OF SECTION

SECTION 16510

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior lighting fixtures and accessories.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts.

E. Fluorescent lamp emergency power supply.

F. Lamps.

1.2 RELATED SECTIONS

A. Section 13080 - Seismic Protection for Mechanical, Electrical Equipment.

B. Section 16010 - General Provisions - Electrical.

C. Section 16170 - Grounding and Bonding.

D. Section 16190 - Supporting Device.

E. Section 16191 - Seismic Restraint Systems.

1.3 CODES AND STANDARDS

A. ANSI C78.1 to C78.1502 Standards for Various Types of Lamps.

B. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

C. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.

D. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).

E. NFPA 70 - National Electrical Code.

F. NFPA 101 - Life Safety Code.

G. UL 924 - Emergency Lighting and Power Equipment.

H. UL 935 - Fluorescent Lamp Ballasts.

I. UL 1570 - Fluorescent Lighting Fixtures.

J. UL 1571 - Incandescent Lighting Fixtures.

1.4 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different fixture, ballast, lamp, exit sign, and emergency power unit. The information shall be in the form of the manufacturer's standard data sheets. Each lighting fixture data sheet shall indicate, by fixture type, the lighting fixture for which it applies.

1. Lighting Fixtures

a. Manufacturer's series or catalog number
b. Dimensioned picture or drawings
c. Material of housings, brackets, etc.
d. Finish
e. Ballast type
f. Lamp type
g. Voltage
h. Lens material, thickness and pattern
i. Louver or reflector material, depth, number of cells, and finish
j. Mounting hardware
k. Photometrics and coefficient of utilization tables.

2. Ballasts

a. Manufacturer's series or catalog number
b. Ballast type
c. Voltage
d. Wattage
e. Power factor
f. Crest factor
g. Harmonic factor

3. Emergency Lighting Units

a. Manufacturer's series or catalog number
b. Dimensioned picture or drawing
c. Housing material and finish
d. Battery type and rated life
e. AC and DC voltages
f. Charger type and charging modes

g. Fixture and lamp type
h. Test switch and indicator lights
i. Control circuitry
j. Photometric for lamps

4. Exit Signs

a. Manufacturer's series or catalog number
b. Dimensioned picture or drawing
c. Housing material and finish
d. Lens material and character size
e. Down light
f. Battery type and rated life
g. AC and DC voltage
h. Charger type and charging modes
i. Lamp type
j. Test switch and indicator lights
k. Control circuitry

5. Fluorescent Lamp Emergency Power Supply

a. Manufacturer's series or catalog number
b. Dimensioned picture or drawing
c. Battery type and rated life
d. AC and DC voltages
e. Charger type and charging modes
f. Test switch and indicator lights
g. Control circuitry

6. Lamps

a. Manufacturer's series or catalog number
b. Picture or drawings
c. Lamp designation
d. Base or pin type
e. Voltage
f. Starting mode
g. Burning temperature
h. Color rendering index
i. Diffuser coatings and reflectors

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.

C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Accurately record actual locations of each lighting fixture and branch circuitry.

1.6 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standard listed in Section 16010.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the U.L. Label.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURES

A. Provide fixtures as specified on the Drawings.

B. Install ballasts, lamps, and specified accessories at factory.

2.2 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

A. Providem emergency lighting units and exit signs as specified on the drawings.

2.3 BALLASTS

A. Fluorescent Ballast:

1. Manufacturers:

a. Advance - Mark V Series
b. Magnetek - Triad Series
c. Universal - Genesis Series

d. Valmont - Ultra-miser Series
e. Approved equal.

2. Description:

a. Class P, high power factor type electronic ballast.
b. Provide ballast suitable for lamps specified.
c. Voltage: As indicated.
d. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.

B. Compact Fluorescent Ballast:

1. Manufacturers:

a. Advance
b. Universal
c. Valmont
d. Approved equal.

2. Description:

a. High power factor type.

2.4 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

A. Manufacturers:

1. Bodine - B50 Series
2. Chloride - CFP8-4 Series
3. Emergi-Lite - EPSI/U Series
4. Universal - 8500 Series
5. Approved equal.

B. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.

C. Lamp Ratings: Two F32T8CW lamp providing 900 to 1100 initial lumens, minimum

D. Battery: Sealed nickel cadmium type, with integral charger, rated for 10 year life.

E. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled fixture.

F. Operation: Emergency ballast shall be wired so that emergency ballast powers lamps only under loss of normal

power (unswitched circuit to battery charger and switched circuit to the fixture ballast) unless fixture is noted as a night light (permanently energized).

2.5 LAMPS

A. Incandescent Lamp:

1. Manufacturers:
   a. General Electric
   b. Sylvania
   c. Philips
   d. Approved equal.

2. Description: 120 volt, inside frosted or reflector type.

B. Fluorescent Lamps:

1. Manufacturers:

   a. General Electric
   b. Sylvania
   c. Philips
   d. Approved equal.

2. Description: T8, rapid start type, medium bipin, 4100 degree K, minimum color rendering index of 75.

C. Compact Fluorescent Lamps

1. Manufacturers:

   a. General Electric
   b. Sylvania
   c. Philips
   d. Approved equal.

2. Description: Twin or quad tube, 3500-4100 degree K.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers instructions.

B. Install the fixtures where indicated, but make adjustments using the same numbers of fixtures in accordance with the Architectural reflected ceiling plan where ceilings exist and verified to be compatible with system.

C. Where suspended ceilings are involved, coordinate recessed fixture types and trims with actual installed ceiling system, and provide all necessary frames and trim to properly complete each particular installation.

D. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.

E. Install wall mounted fixtures, emergency lighting units and exit signs at height indicated on Drawings.

F. Install accessories furnished with each fixture.

G. Connect fixtures and emergency lighting units to branch circuits using flexible conduit.

H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture.

I. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.

J. Install specified lamps in each fixture, emergency lighting unit and exit sign.

K. Recessed lay-in type fluorescent fixtures shall be secured to the ceiling tee bar by running a self-tapping screw through the vertical part of the tee bar main runners only and the fixture at each of the four corners of the fixture. In addition, support the fixture from the structure above with two 12 gauge steel wires attached to the fixture at diagonally opposite corners.

L. Surface and wall mounted fixtures shall be secured with a minimum of four bolts or screws. Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, slab, stud or other support added for this purpose. Do not secure or support the weight of the fixtures from gypboard on walls or any ceiling material. Fixtures attached to ceiling tees shall be attached to the main runners only with at least two positive clamping devices such as U-bolts. Rotational spring catches or other clips shall not be used. A 12 gauge steel wire shall be attached to each clamping device and to the structure above.

M. Where fluorescent fixtures are suspended with chain hangers, the hangers shall be secured to the fixture and the structure with screws or bolts. Do not use clips or fasteners.

N. Recessed flanged type fluorescent fixtures shall be secured using adjustable swing-gate type hangers that fit over the ceiling support member around the opening and adjusted to secure the fixture flange tight against the ceiling. The hangers shall be adjustable from inside the fixture and a minimum four shall be provided for each fixture. A self-tapping screw shall be run through the end cap of the fixture and the vertical part of the ceiling framing at each of the four corners of the fixture. In addition, support the fixture from the structure above with two 12 gauge steel wires attached to the fixture at diagonally opposite corners.

O. Recessed incandescent, compact fluorescent and H.I.D. fixtures installed in lay-in type ceilings shall be supported from the tee bar system using suspension bar hangers designed for the purpose that fasten to the vertical part of the tee bar. Support the fixture from the main runners only. Do not secure to or support the weight of the fixture from the ceiling material. Secure the bar hanger to the tee by running a self-tapping screw through the vertical part of the ceiling tee and the fastener on each end of the bar hanger. In addition support the fixture from the structure above with one 12 gauge steel wire attached to the fixture at a point as near to the center as possible.

P. Recessed incandescent, compact fluorescent and H.I.D. fixtures installed in non-lay-in type ceilings shall be supported from the ceiling support system using suspension bar hangers designed for the purpose that fasten to the support system. Do not secure to or support the weight of the fixture from the ceiling material. Secure the bar hanger to the support system by running a self-tapping screw through the vertical part of the ceiling support and the fastener on each end of the bar hanger. In addition support the fixture from the structure above with one 12 gauge steel wire attached to the fixture at a point as near the center as possible.

Q. Fixtures recessed in walls shall be secured with a minimum of four bolts or screws. Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, stud or other support added for the purpose. Do not secure or support the weight of the fixture from gypboard on walls. Provide two screws on opposite sides or top and bottom of the fixture.

R. Exit signs shall be secured to an outlet box with a minimum of two screws. The outlet box shall be secured as specified in Section 16130.

S. Surface and wall mounted fixtures larger than 8 inches in any dimension or weights more than 40 pounds shall be supported independently of the outlet box and secured with a minimum of four bolts or screws. Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, concrete or masonry wall, or ceiling support member, stud or other support added for this purpose. Do not secure or support the weight of the fixture from gypboard on walls or any ceiling material. Smaller fixtures shall be supported from the outlet box and secured with a minimum of two screws. The outlet box shall be secured as specified in Section 16130. Fixtures attached to ceiling tees shall be attached to the main runners only with at least two positive clamping devices. Rotational spring catches or other clips shall not be used. A 12 gauge steel wire shall be attached to each clamping device and to the structure above.

3.2 FIELD QUALITY CONTROL

A. Operate each fixture after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Aim and adjust luminaires as directed.

B. Adjust exit sign directional arrows as indicated.

C. Relamp luminaires at Substantial Completion.

3.4 CLEANING

A. Remove dirt and debris from enclosure.

B. Clean lenses and reflector surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

END OF SECTION

SECTION 16670

LIGHTNING PROTECTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical.

B. Section 16111 - Conduit.

C. Section 16170 - Grounding and Bonding.

D. Section 16190 - Supporting Devices.

1.3 CODES AND STANDARDS

A. LPI-175 - Lightning Protection Installation Standard.

B. LPI-176 - Lightning Protection System Material and Components Standard.

C. LPI-177 - Inspection Guide for LPI Certified Systems.

D. NFPA 78 - Lightning Protection Code.

E. UL 96 - Lightning Protection Components.

F. UL 96A - Installation Requirements for Lightning Protection Systems.

1.4 SYSTEM DESCRIPTION

A. Lightning Protection System: UL Class 1 Conductor system protecting the structures consisting of air terminals on roofs, roof-mounted mechanical equipment, parapets, bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors.

1.5 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and

conductor sizes, and connection and termination details. Shop drawings shall be provided by the material manufacturer.

B. Data Sheets: Provide dimensions and materials of each component, and include indication of listing in accordance with UL 96.

1.6 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors on project record documents and/or manufacturer's shop drawings.

1.7 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Maintenance Data: Submittal data sheets and shop drawings.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 78 780 and other codes and standards listed in Section 16010.

B. Perform Work in accordance with UL 96A and provide Master Label.

C. Perform Work in accordance with LPI-175 and provide LPI Certification.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum five years documented experience.

B. Installer: Authorized installer of manufacturer with minimum five years documented experience.

1.10 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70 and 78.

B. Furnish products listed and classified by UL as suitable for the purpose specified and indicated. Products shall bear the UL Label.

1.11 FIELD MEASUREMENTS

A. Verify measurements indicated on shop drawings.

1.12 COORDINATION

A. Coordinate work with roofing and exterior and interior finish materials and installations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. A.C. Lightning Security

B. Heary Brothers Lightning Protection

C. Robbins Lightning Protection

D. Thompson Lightning Protection Inc.

E. Approved equal.

2.2 COMPONENTS

A. Air Terminals: these shall be 1/2 inch minimum diameter solid copper. The length shall be 24 inches long. They shall have a tapered point and a threaded end for connection to an air terminal base. Tubular air terminals are not acceptable.

B. Main Conductors: There shall be copper.

1. Copper conductors shall be bare electrical grade copper cable of a minimum 28 strands, 14 AWG wire, 375 lbs/1000 ft., 115,000 CM.

C. Secondary bonding conductors: These shall be copper.

1. Copper conductors shall be electrical grade bare copper cable of a minimum 14 strands, 17 AWG, 92 lbs/1000 ft., 26,240 CM.

D. All devices shall have bolt pressure cable connectors with a minimum of 1-1/2 inches of cable contact and stainless steel bolts. Devices with crimp type cable connectors are not acceptable, except where specified.

E. Air Terminal Bases: These shall be cast copper or with a cable connector. Provide swivel air terminal connectors or adjustable bases for mounting on sloped surfaces.

F. Structural Steel Bonding Plates: These shall be cast copper, with a cable connector. The plate shall have a minimum bonding contact area of 8 square inches and holes for four 5/16 inch bolts for mounting.

G. Cable Splicers and Connectors: Single metal type shall be cast copper. Bimetal type shall be cast bronze or brass and aluminum or stainless steel. Both types shall have a minimum of 2 inches of cable contact for each leg. They shall be pull rated for 200 lbs.

H. Thru-Roof and Thru-Wall Cable Fittings: These shall include a copper, brass, bronze, stainless steel or aluminum threaded rod with cast copper or cable connectors on each end as required. The length shall be as required. All nuts and washers shall be stainless steel. Provide proper flashing or sealing devices.

I. Air Terminal Braces: These shall be tripod type with 1/4 inch mild steel legs and heavy section washer guides. All joints shall be welded. The feet shall be annealed to permit shaping. The brace shall be hot galvanized after assembly. Bolt down type feet shall have holes for two 1/4 inches bolts per foot. Adhesive type feet shall have adhesive plates.

J. Ground Rods: These shall be copper clad steel, 3/4 inch, minimum diameter and 10 feet long sectional type with tapered point and threaded end. Where rod sections are required to be connected, they shall be connected with high strength copper alloy or bronze couplers, or by exothermic welds.

K. Exothermic Welds: These shall be made by an exothermic process which produces molecular bonding of the conductors and ground rods or other objects to which they are connected. They shall be approved for exposure to the elements or direct burial without degradation. The welds shall be made using graphite molds which are the proper size and design for the conductors and other objects to be welded and the type of weld configuration. The weld material shall be a copper oxide and aluminum mixture with a minimum 3 percent tin. The starting material shall consist of aluminum and copper and iron oxides and can be only ignited by a spark ignitor designed for that purpose. It shall not contain phosphorous or any caustic, toxic, or explosive substance. Provide all proper tools and miscellaneous devices required. All of the welding components shall be of the same manufacturer.

L. Cable Fasteners: for fastening to wood, masonry and

metal, these shall be heavy gauge stamped copper loop or strap type and sized as required. For fastening to built-up and single membrane roof material, these shall be heavy gauge stamped copper or crimp type with an adhesive base.

M. Miscellaneous bolts, nuts and screws: These shall be brass, aluminum or stainless steel and sized as required.

N. Adhesives: These shall be a type approved by the manufacturer of the lightning protection equipment and the roof material manufacturer. A letter of approval from the lightning protection equipment and the roof material manufacturers shall be obtained and submitted with the product submittals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 78 and the manufacturer's shop drawings and written instructions.

B. All connections to counterpoise, ground rods and other non-accessible devices below grade shall be made by exothermic welds.

3.2 FIELD QUALITY CONTROL

A. The system shall be tested in accordance with NFPA 78. Resistance value shall not exceed 10 ohms. Provide additional ground rod sections to achieve resistance values.

B. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and labeling of the lightning protection system in accordance with UL 96A.

C. Obtain the services of the Lightning Protection Institute to provide inspection and certification of lightning protection system in accordance with LPI-177.

END OF SECTION

SECTION 16721

FIRE ALARM SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm control panels.

B. Manual fire alarm stations.

C. Automatic smoke and heat detectors.

D. Fire alarm signaling appliances.

E. Auxiliary fire alarm equipment.

1.2 RELATED SECTIONS

A. Section 14245: Hydraulic Elevators - Passenger.

B. Section 15855 - Air Handling Units with Coils.

C. Section 15910 - Ductwork Accessories.

D. Section 15980 - HVAC control system.

E. Section 16010 - General Provisions - Electrical.

F. Section 16111 - Conduit.

G. Section 16123 - Building Wire and Cable.

H. Section 16130 - Boxes

I. Section 16170 - Grounding and Bonding

J. Section 16180 - Equipment wiring Systems

K. Section 16190 - Supporting Devices

L. Section 16191 - Seismic Restraint Systems

M. Section 16195 - Electrical Identification

1.3 CODES AND STANDARDS

A. NFPA 70 - National Electrical Code.

B. NFPA 72 - National Fire Alarm Code.

C. NFPA 101 - Life Safety Code.

D. UL 268: Smoke Detectors for Fire Protective Signaling Systems.

E. UL 268A: Smoke Detectors for Duct Application. Rev. 3/86

F. UL 521: Heat Detectors for Fire Protective Signaling Systems.

G. UL 864: Control Units for fire Protective Signaling Systems.

H. SBC - Standard Building Code.

I. SFPC - Standard Fire Prevention Code.

J. UBC - Uniform Building Code.

K. BOCA - Basic National Building code.

L. Local Codes and Ordinances

1.4 SYSTEM DESCRIPTION

A. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits.

1.5 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Shop Drawings: System wiring diagram showing each device and wiring connection to existing fire alarm system. Provide floor plans showing device locations and conduit routing and sizes.

B. Data Sheets: Submit as a minimum the following information on each different device. The information shall be in the form of the manufacturer's standard product data sheets.

1. Initiating Devices

a. Manufacturer's series or catalog number.
b. Type of device
c. Ratings
d. Mounting type
e. Mounting base
f. Auxiliary devices
g. Dimensioned picture or drawing

2. Signaling Devices

   a. Manufacturer's series or catalog number
   b. Type of device
   c. Ratings
   d. Mounting type
   e. Annunciator elevation and legend
   f. Dimensioned picture or drawing

3. Auxiliary Devices

   a. Manufacturer's series or catalog number
   b. Type of device
   c. Ratings
   d. Mounting type
   e. Dimensioned picture or drawing

4. Wiring

   a. List the NEC designations for the wiring to be used and what it is to be used for.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, start-up and testing of the system.

D. Fire Department Review: Submit plans and specification to the local Fire Department for approval and comments.

E. Fire Department Comments: Submit Fire Department review comments.

1.6 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual locations of initiating devices, signaling devices.

1.7 OPERATION AND MAINTENANCE DATA

A. Refer to Section 16010.

B. Operation Data: Operating instructions.

C. Maintenance Data: Maintenance and repair procedures, shop drawings and submittal data sheets.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standards listed in Section 16010.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.10 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. All products shall bear the UL Label.

1.11 COORDINATION

A. The locations of devices indicated on the drawings are approximate. Coordinate the exact location with the architectural details and equipment.

B. Coordinate the fire alarm system with the local Fire Department, Division 15 and all other appropriate Sections.

1.12 EXTRA MATERIALS

A. Provide ten manual station break-glass rods.

B. Provide six keys of each type.

C. Provide three of each type of automatic smoke detector without base.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Manufacturer must be at minimum compatible with the existing fire alarm system, field verify.

A. Edward Systems Technology

B. Notifier

C. Simplex

D. Pyrotronics

E. Approved equal.

2.2 INITIATING DEVICES

A. Manual Station: Semi-Flush mounted type, double action manual station with break-glass rod. Provide manufacturer's standard backbox.

B. Spot Heat Detector: Combination rate-of-rise and fixed temperature, rated 135 degrees F, and temperature rate of rise of 15 degrees F. Detectors shall have minimum coverage of 900 square feet.

C. Ceiling Mounted Smoke Detector: Photoelectric type with adjustable sensitivity, suitable for mounting on 4 inch outlet box.

D. Duct Mounted Smoke Detector: photoelectric type with auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing.

E. Remote Visual Indicators: LED type visual indication of smoke detector status, suitable for mounting on a standard single gang outlet box. Provide manufacturer's standard prelabeled coverplate.

2.3 SIGNALING DEVICES

A. Alarm Lights: ADA approved strobe lamp and flasher with red lettered "FIRE" on white background. Lights to be a minimum of 110 candle power.

B. Alarm Horn: NFPA 72G, surface projector type, as indicated fire alarm horn. Sound Rating: 87 dB at 10 feet. Provide integral ADA approved strobe lamp and flasher with red lettered "FIRE" on white background.

2.4 FIRE ALARM WIRE AND CABLE

A. Fire Alarm Circuits: National Electrical Code listed copper wiring, and cable of the size and type indicated on the manufacturer's shop drawings.

2.5 SOFTWARE PROGRAMMING

A. All software shall be provided to provide a complete operating system able to perform all of the items described in the sequence of operation and all graphic

displays.

2.6 AUXILIARY DEVICES

A. Door Release: Magnetic door holder with integral diodes to reduce buzzing. Coil voltage: 24 VDC.

2.7 POWER SUPPLY

A. Provide new emergency power supply compatible with existing fire alarm system. Power limited; adequate to serve control panel modules, remote detectors, remote annunciators, door and power all required system functions. In addition, provide 20 percent spare capacity in the power supply for future additions to the system. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 ours and in addition, operate under full capacity for a minimum period of 5 minutes in an alarm condition.

2.8 REMOTE ANNUNCIATOR

A. Provide new remote annunciator compatible with existing fire alarm system. Provide remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in flush or surface wall-mounted enclosure as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Contractor shall ensure that the overall operation of the fire alarm system (new and existing equipment) is in accordance with NFPA 72 and all other applicable codes.

B. Install products in accordance with manufacturer's shop drawings, instructions and the listed codes and standards.

C. All smoke detectors for the entire fire alarm system, including those located within the AC equipment and/or ducts, shall be furnished and wired under the Electrical Section. Smoke detectors located in the AC units and/or ducts shall be properly installed therein by the AC Section, ready for electrical connections; all other smoke detectors shall be installed by the Electrical Section.

D. Mounting heights of wall mounted devices shall be in accordance with NFPA 72.

E. Install all fire alarm system wiring in conduit.

F. Provide all outlet and backboxes as required by the manufacturer in accordance with their specifications.

G. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

H. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

I. Devices and backboxes in or on the ceiling shall be supported by the ceiling support system using support channels or hangers. the weight of the device or the backbox shall not be supported by the ceiling material.

J. A 90 degree angle bracket shall be installed on each end of each support channel with a self-tapping metal screw run through each bracket and the ceiling support tee to secure the bracket to the tee. If a support channel with a integral tee bar fastener is used, a self-tapping metal screw shall be run through each fastener and the ceiling support tee to secure it to the tee. Devices and backboxes shall be supported from the main runners only.

K. Ceiling mounted smoke detectors shall be secured to the backboxes with a minimum of two screws of size required by the detector manufacturer.

L. Backboxes flush mounted in gypboard and stud walls for semi-flush and wall mounted audio-visual signal devices shall be secured to the studs and/or bracing with four screws; two in top and bottom, opposite sides, or each corner of the back. Provide vertical and horizontal bracing in the wall to support the weight of the audio visual device and receive the screws.

M. Provide a bushings with an insulated throat on the ends of all conduits where they terminate in outlet or junction boxes, equipment cabinets, etc.

N. Conduit types, fittings, routing and support shall be as specified in Section 16111, 16190 and 16191.

O. Outlet and backboxes shall be supported as specified in Section 16130, 16190 and 16191 unless otherwise specified.

P. Where smoke detectors are mounted in ducts above the ceiling, mount the remote LED indicator through the ceiling, at the smoke detector location, so that it will be visible from the corridor or room. Provide a 3/4 inch wide by length required, laminated white plastic nameplate

engraved with "Duct Smoke Detector" in 1/2 inch high red letters. Permanently attach the nameplate to the ceiling support grid next to the indicator.

Q. All wire shall be tagged at all junction points and shall test free of grounds or crosses between conductors.

R. Final connections between equipment and system wiring shall be made under the direct supervision of a representative of the manufacturer.

S. Final connections between equipment and system wiring shall be made under the direct supervision of a representative of the manufacturer.

T. Equipment shall be installed by a duly licensed electrical contractor or a duly licensed Fire Alarm Installer as required by local code. The equipment warranty must be provided by a licensed Fire Alarm Supplier.

U. The covers of all pull boxes and junction boxes in the conduit system for the fire alarm system shall be painted red to identify them.

V. Provide tamper switches on all junction boxes mounted exposed and at or below an elevation of 8 feet (2.4 m) above the finished floor or grade. A trouble alarm shall be activated if the coverplate is removed.

3.2 FIELD QUALITY CONTROL

A. Following complete installation, perform all operations specified and tests in presence of the Government's, local fire Department's, and Engineer's representative. The contractor and equipment supplier shall provide all equipment and personnel to perform the tests.

B. Test in accordance with NFPA 72 and local fire department requirements.

3.3 MANUFACTURER'S FIELD SERVICES

A. Include services of certified technician to supervise installation, adjustments, final connections, check-out, and system testing.

3.4 OWNER ORIENTATION AND INSTRUCTION

A. A representative of the fire alarm system manufacturer shall meet with representatives of the Government at the time of the final acceptance of the system and shall train the Government's representatives in the operation of the system and review the operation and maintenance manuals to be provided to the Government and recommend maintenance procedures.

END OF SECTION

SECTION 16741

INTERIOR TELEPHONE AND DATA, PATHWAYS, AND WIRING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Conduit and raceway.

B. Termination backboards.

C. Termination cabinets.

D. Outlet and pull boxes.

E. Service fittings.

F. Cable

G. Outlet devices and plates

H. Termination equipment

1.2 RELATED SECTIONS

A. Section 16010 - General Provisions - Electrical

B. Section 16111 - Conduit

C. Section 16115 - Indoor Service Poles

D. Section 16130 - Boxes

E. Section 16160 - Cabinets and Enclosures

F. Section 16170 - Grounding and Bonding

G. Section 16180 - Equipment Wiring Systems

H. Section 16190 - Supporting Devices

I. Section 16191 - Seismic Restraint Systems

J. Section 16195 - Electrical Identification

1.3 CODES AND STANDARDS

A. EIA/TIA-568 - Commercial Building Wiring Standard.

B. EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.

C. ICEA-S-80-576 - Communication Wire and Cable for Wiring of Premises.

D. NFPA 70 - National Electrical Code.

1.4 SYSTEM DESCRIPTION

A. Contractor shall provide conduits, equipment racks, patch panels, outlet and pull boxes, backboards, cable supports, all wiring and cabling, outlet devices, termination equipment and various service fittings as indicated on the drawings and as specified.

B. The distribution system shall be installed and tested so that the system is fully operational when the telephone equipment is installed and connected to it.

1.5 SUBMITTALS: Submit under provisions of Section 01300. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information. The information shall be in the form of manufacturer's standard data sheets or drawings.

1. Conduit: As specified in Section 16111.
2. Indoor Service Poles: As specified in Section 16115.
3. Outlet and Pull Boxes: As specified in Section 16130.
4. Service Fittings: As specified in Section 16140.
5. Cable and patch Cords

a) Number and size of conductors
b) Conductor material
c) Shielded or unshielded
d) Color coding
e) Insulation and jacket material
f) UL Ratings such as: plenum, riser, etc.
g) UL Listed Category rating
h) Conforming standards

6. Connector Blocks

a) Block style
b) Block material
c) Contact type and material
d) Cable pair capacity
e) Wall bracket type and material
f) Labeling provisions
g) Miscellaneous items such as bridging clips, etc.
h) Dimensions

7. Patch Panels

a) Type and material
b) UL Listed Category rating
c) Number and type of jacks
d) Wall bracket type and material
e) Labeling provisions
f) Miscellaneous items
g) Dimensions

8. Modular jacks

a) Type and material
b) Wiring Configuration
c) Type of wiring termination
d) Contact material
e) UL Listed Category rating
f) Conforming standards
g) Dimensions

9. Wall Plates

a) Material and color
b) Number and type of provisions for jacks
c) Dimensions

10. Equipment Racks

a) Type and material
b) Dimensions

B. Test Data: Tabulated test readings for each circuit.

1.6 PROJECT RECORD DOCUMENTS

A. Refer to Section 16010.

B. Record actual locations and sizes of conduits, raceways, cabinets, backboards, outlets and service fittings. Record the actual station numbers assigned to the outlets.

C. Record the actual location of any underground or underfloor conduits. Dimension the location in reference to exterior walls and column lines.

D. Test Data: Final, tabulated, accepted, test readings for each circuit with each outlet and connection identified as labeled in the field.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with codes and standards listed in Section 16010.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. All products shall bear the UL Label.

1.9 COORDINATION

A. The locations of telephone and data outlets, service fittings, etc. indicated on the drawings are approximate. Determine the actual locations where outlets are to be coordinated with modular wall and furniture systems.

PART 2 PRODUCTS

2.1 TERMINATION BACKBOARDS

A. Material: A-D grade Plywood; A grade exposed.

B. Size: As indicated, 3/4 inch thick.

C. Secure backboard to walls as required.

D. Finish: Two-coat insulating varnish.

2.2 CONDUIT, RACEWAYS, UNDERFLOOR DUCT AND SERVICE POLES

A. Description: Conduit, raceways, ducts and service poles shall be as specified in the appropriate sections.

B. Conduit sizes shall be as indicated on the drawings.

2.3 OUTLET AND PULL BOXES

A. Description: Boxes shall be as specified in Section 16130. Outlet boxes shall be single or ganged type as indicated and shall be a minimum of 2-1/8 inches deep.

2.4 STATION CABLE

A. Enhanced Category 5 Cable:

1. Description: 4 pair, No. 24 AWG, solid copper, unshielded, twisted pair, color coded, with PVC conductor insulation and overall jacket. The cable shall conform to the requirements of EIA/TIA-568B and ICEA S80-576 and shall be UL Certified to meet the requirements of EIA/TIA TSB-36 for category 5 cable. The cable shall be

nonplenum or plenum rated as required.

B. Manufacturers

1. AT&T
2. Belden
3. Berk-Tek
4. Champlain
5. Northern Telcom
6. Approved equal.

2.5 BACKBONE CABLE (ENHANCED CATEGORY 5)

A. Description: No. 24 AWG, solid copper, unshielded, twisted pair, color coded with PVC conductor insulation and overall jacket. The cable shall conform to the requirements of EIA/TIA-568B and ICEA S80-576 and shall be UL Certified to meet the requirements of EIA/TIA TSB-36 for category 5 cable. The cable shall be plenum rated.

B. Manufacturers

1. AT&T
2. Berk-Tek
3. Champlain
4. Approved equal.

2.6 RISER CABLE (VOICE ONLY)

A. Description: No. 24 AWG, solid copper, unshielded, twisted pair, color coded with PVC conductor insulation, polypropylene film core wrap, corrugated aluminum sheath and overall jacket. The cable shall be UL Listed for riser cable.

B. Manufacturers

1. AT&T
2. Essex
3. Approved equal.

2.7 CONNECTOR BLOCKS

A. Description: 110 style, high-impact, fire-retardant molded plastic. The cable pair capacity shall be as indicated. Provide standoff wall mount brackets, bridging clip, labeling provisions, etc. as required for a complete installation.

B. Manufacturers
1. Amp
2. AT&T

3. Hubbell
4. Krone
5. Leviton
6. Mod-Tap
7. Ortronics
8. Siemon
9. Approved equal.

2.8 PATCH PANELS

A. Description: UL Listed Category 5, 9printed circuit board type with 110 style wire connections, with the number and type of jacks as indicated. Provide a hinged standoff wall mount bracket as required for the cable capacity of the patch panel, labeling provisions, etc. required for a complete installation.

B. Manufacturers

1. Amp
2. AT&T
3. Hubbell
4. Krone
5. Leviton
6. Mod-Tap
7. Ortronics
8. Siemon
9. Approved equal.

2.9 PATCH CORDS

A. Description: 4 pair, No. 24 AWG, stranded copper, unshielded, twisted pair, color coded, with PVC conductor insulation and overall jacket. The cord shall conform to the requirements of EIA/TIA-568B and shall be UL Certified for category 5. Provide connectors on both ends to match the type and wiring configuration of the jacks.

B. Manufacturers

1. Amp
2. AT&T
3. Hubbell
4. Krone
5. Leviton
6. Mod-Tap
7. Ortronics
8. Siemon
9. Approved equal.

2.10 MODULAR JACKS

A. Description: RJ45, plastic, simplex, snap-in type. The jacks shall be lead wire or printed circuit board type with 110 style wire terminations for No. 24 AWG wire. The contacts shall have a minimum 50 micro inch gold plating over 100 micro-inch nickel underplate. They shall be UL Listed for Category 5 as required for their indicated application and they shall meet FCC Part 68 and TIA 568 requirements.

B. Manufacturers:

1. Amp
2. AT&T
3. Hubbell
4. Krone
5. Leviton
6. Mod-Tap
7. Ortronics
8. Siemon
9. Approved equal.

2.11 WALL PLATES

A. Description: Modular jack to match the power receptacle and switch plates. Plates shall have prestamped holes for modular jacks. The number and type of modular jack provisions shall be as indicated. Attachment screw heads shall match the plate.

2.12 COLOR OF DEVICES AND CABLE

A. Description: The Contracting Officer shall select the color of all outlet devices and cable.

2.13 MISCELLANEOUS ITEMS: The contractor shall provide miscellaneous items such as connectors, screws, cable ties, etc. as required for a complete and operable installation.

2.14 EQUIPMENT RACKS

A. Floor mounted equipment racks shall be welded steel relay racks with uprights to mount equipment 22 inches wide. Uprights shall be 3 inch deep channel, 1-1/4 inches wide, drilled and tapped 12-24 in a 1/3-inch pattern. Racks shall be provided with a standard top cross member, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 7 feet in height and clear coated.

PART 3 EXECUTION

3.1 INSTALLATION

A. The number and type of devices shall be as indicated and/or as specified.
B. All telephone and data wiring shall be run in conduit from the outlet box to the cable tray.
C. Telephone and data wiring may be run without conduit in accessible ceiling spaces not used as return air plenums. Wiring shall be run in conduit or U.L. Listed plenum rated cable shall be used in all ceiling spaces used as return air plenums.
D. Wiring shall be run in conduit in walls and any other inaccessible spaces; in wet and damp locations and in crawl spaces.
E. Cable run without conduit shall be routed within cable tray.
F. Main or trunk cables shall be run in conduit.
G. Where cable is run without conduit, cable fittings shall be provided where cable enters cabinets, backboxes, etc. to secure the cable and provide strain relief. The fittings shall grip but not damage the cable insulation and shall be designed for this purpose.
H. In rooms or spaces without ceilings, cable may be run exposed on the structure without conduit above eight feet above the finished floor. Cable shall be supported at a maximum 24 inches on center with devices designed for this purpose secured to the walls or structure. Cable run below eight feet shall be in conduit.
I. Where cable run without conduit passes through walls or floors, conduit sleeves shall be provided. Provide a bushing with an insulated throat on each end of the sleeve.
J. Cables shall be run unspliced between distribution frames, and patch panels and from distribution frames or patch panels to the station outlet.
K. Terminate cables at the connector blocks, patch panels, and station outlet devices.
L. Do not bend cable to a smaller radius than the minimum recommended by the manufacturer or the installation standard EIA/TIA-568 for the system category for which the cable will be used.
M. Do not use pulling compounds.
N. Bundle and train cables neatly where multiple cables are run together without conduit or raceway such as in equipment rooms, above ceilings, etc.
O. Bundle, train and lace cables neatly on equipment backboards. Use cable spools or guides as required.
P. Use termination tools and methods recommended by the station outlet and termination equipment manufacturer.
Q. Conduit routing and support shall be as specified in

Sections 16111, 16190 and 16191.

R. Conduits indicated shall be installed in accordance with Section 16111 with the additional requirements that no length of run shall exceed 50 feet for ½-inch and 3/4-inch sizes, and 100 feet for 1-inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1-inch size or larger shall be not less than ten times the nominal diameter.

S. Provide a bushing with an insulated throat on the ends of all conduits where they terminate in outlet, pull or junction boxes, cabinets, at termination backboards or stubbed into ceiling spaces.

T. Seal around cables thru sleeves and around all conduit and sleeve penetrations through floors and walls.

U. Paint termination backboards as specified under the provisions of Section 09900 prior to installation of telephone equipment.

V. Support raceways, backboards, connector block, patch panels, and cabinets under the provisions of Section 16190 and 16191.

W. Install termination backboards plumb. Install cabinet trim plumb.

X. Mark all junction and pull boxes as specified in Section 16130.

Y. Provide a plastic nameplate on the termination cabinet as specified in Section 16160 and 16195.

Z. Label each cable termination at both the termination equipment and the station outlet device. Coordinate the designations with the Contracting Officer and the telephone system supplier.

AA. The Contracting Officer shall provide the contractor with the coding scheme for outlet devices, connector blocks and patch panels. The contractor shall identify each outlet device circuit by applying preprinted tape markers, indicating the station number, to each cable at the outlet device and at the connector block and patch panel including any required patch cords. Ech connection point on the connector block and patch panel shall be identified with the station number. Identify all pairs of backbone and riser cables at the connector blocks and patchpanels. See Section 16195.

AB. Install cables in accordance with the manufacturer's recommendations in regard to maximum pulling tensions, pulling methods, etc. Where more than one cable is to be installed in the same conduit or raceway, pull all cables together.

3.2 GROUNDING

A. Grounding shall be as indicated and conform to the requirements of the TIA-607 and NEC standards.

3.3 TESTING

A. The contractor shall provide all testing equipment to perform the required tests.

B. Testing procedures shall be in accordance with EIA/TIA 568. Tests shall be performed with all devices, connections, terminations, patch cords, etc. in place.

C. Visual Test: Visually inspect the wiring and connections for proper color coding, numbering, etc.

D. Continuity Test: Test each pair for continuity, shorts to ground, shorts to other pairs, splits, and reversed polarity.

E. Performance:

1. Provide attenuation, worst case link near end crosstalk loss measured from the outlet, and worst case near end crosstalk measured from the main connector block or patch panel for each circuit. The valves shall be measured for frequencies up to 16 MHz for category 3 circuits and up to 100 MHz for category 5 circuits, at intervals required in the EIA/TIA 568 standard. All values shall be recorded in a table format and submitted to the Contracting Officer for acceptance.

F. Any circuits that do not meet acceptable values set forth in EIA/TIA 568 and/or not accepted by the Contracting Officer shall be reworked and retested until it meets the standards.

END OF SECTION